ECONOMIC CLIMATE

CLOSE BALANCE in the economic situation is leading to restraint by businessmen in planning future expansion and in setting production rates. This, in turn, creates additional hesitancy. The fact that there are no apparent signals of a dynamic upward push in the economy in the near future is more or less offset by the absence of any sign that business is about to plummet from its high level under the weight of stagnation.

BUSINESS CONDITIONS in the U. S. are "somewhat healthier than they were a year ago," despite uncertainties, says Per Jacobsson, chief of the International Monetary Fund and one of the world's most respected conservative economists.

EMPLOYMENT PROBLEMS will get worse over the coming months as the number of workers available continues to grow more rapidly than employment opportunities. Automation will increase, speeding its inroads into the country's industrial posture and virtually assuring aggravation of this problem over the long term. Composition of the labor force is starting a dramatic change. During the 1960s, 13.5-million new workers will become available. But there will be virtually no increase in the 25-to-45 age group traditionally preferred by employers. The growth will occur primarily among those groups which historically have been most susceptible to the adverse effects of technological developments.

MANAGEMENT VIEW

CAPABILITY: UP 6.5% IN '61--Growth of U. S. electric power capability to 187.2-million kw in the coming year is expected, according to EEI's Pres. Sherman R. Knapp. To reach this, electric companies will add 7.5-million kw, governmental agencies 3.8-million kw. Other predictions, vs. 1960, for contiguous U. S. (excluding Alaska, Hawaii): Total sales--Up 7.2% to 715-billion kwh. Construction expenditures--Up from $3.35- to $3.41-billion. Revenues (investor-owned companies)--Up 6.8 percent to $12.25-billion. In 1961, according to EEI, average kwh consumption by the U. S. family will increase 230 to a new high of 3,815.

SURVEY: APPRECIATIVE SHAREHOLDERS turned up by the hundreds when Citizens Utilities Co. of Stamford, Conn., questioned them recently, got a whopping 59-percent response! Citizens' survey confirmed overwhelming interest in company's stock dividend policy and earnings-per-share--these considerations being the "first choice" reasons of some 70-percent of stockholders for remaining with this investment. Fifty-percent of the utility's shareholders (ave. holding: $7600) have their largest investment in Citizens' stock, but 56-percent own stock in from one to four other utility companies . . . and 63-percent own stock in from 3 to 20 companies at one time. Seventy-four percent of Citizens' shareholders have held the stock less than five years.

DEPTH ON THE BENCH should be a prime concern of top management, urges an authority in industrial administration, Dr. Melvin Anshen, professor at Carnegie Institute of Technology. Addressing the utility executive conference staged annually by Middle West Service Co., Prof. Anshen recommended having more than one man to replace each key man in the organization. To further executive development, he advised management to be more concerned about the developmental influences already working in a company, citing as areas where a company can help upcoming talent: (1) learning how to handle his people better, (2) learning to use his own time better, (3) learning how to participate more effectively in his organization and his community. (See story on page 32.)

QUALITY OF PERSONNEL, however, may be at least as important an objective to utility management in planning for both today's performance and the replacement needs of tomorrow. Thus, at Arizona P.S., for example, a goal reached is the reduction of the average number of people

in the "chain of command," from as many as 12 only 1½ years ago to about five people today. (In the five, presumably, are the "cream" for replacement needs, already pre-selected from the dozen previously figuring with somewhat diluted prominence in the team effort.)

FIRMER CREDIT POLICIES may not be the answer to growing problems with uncollected dollars. Arizona P.S. Co.'s Earl Mayer advised a PCEA-PCGA conference to look hard at collection problems before running the risk of creating adverse customer relations through a switch to a policy of clamping down on overdue accounts. He urged: following a set credit policy . . . and tightening up on lax collections to head off the problems.

TEAMWORK IN PROCUREMENT would seem to be an objective of management now more than ever. In the same PCEA-PCGA meeting last month, purchasing people offered these views: Arizona P.S. Co.'s Raymond Hill, referring to a growing need for more understanding between departments, expressed concern for the possibility of engineering departments "usurping the purchasing function of source selection . . . "; but, PG&E's W. G. Johnson urged purchasing officials not only to permit but to encourage vendors to communicate with "specialists" in other departments . . . "because you just don't have time . . . and (because) one of your main activities is to coordinate . . ."

"GATHERING OF THE CLAN" is the way Central Maine Power Co. described its recent one-day presentation of a program titled: "The Forward Look." For some 300 supervisors, local representatives and other key public-contact personnel attending, Exec. V-P Wm. H. Dunham summarized the "look" this way: "future load horizons that are practically unlimited . . . and, we should increase sales by at least 75-percent by 1970 . . . and they could double."

TAILORING THE MOLECULE for precise dielectric and mechanical properties--a challenge in the hands of electrical insulation manufacturers--"will be most important to the future of electric power service and the continued growth of customer use." This assurance was given to the recent National Conference on the Application of Electrical Insulation by Detroit Edison's Pres. Walker L. Cisler who delivered the principle address for the Conference "Unity of Action" banquet. How can electric power systems be helpful?--"By presenting (to the manufacturers) for consideration . . . the operating problems of today and the operating needs that will develop in the years ahead," observed Mr. Cisler.

WASHINGTON INFLUENCE

GOVERNMENT SUBSIDIES and subsidy-like programs have been examined by the Joint Economic Committee. The study reaches no conclusions. It notes, however, that the REA interest rate "is lower than the rate at which the Treasury Department can now borrow long and intermediate term funds." It adds that during much of REA's history, "the borrowing costs to the Treasury Department have been estimated by some analysts to have been less than 2 percent."

"It becomes difficult to determine what elements of subsidy are involved in the costs of entire projects" dealing with natural resources, the report notes, adding, "It has also been seriously questioned whether the power rates TVA charges are adequate to cover all capital costs, and to the extent that those costs are not covered, as they must be by private utilities, those benefiting from the lower TVA rates receive a subsidy." In fact, the report observes, "any Federal public works, once approved and begun, will obviously funnel funds and benefits into the area in which it is located, with the cost borne by the Nation's taxpayers as a whole."

$10 MILLION MARK in the sale of 2-percent REA bonds to co-ops was reached in less than 6 months from the start of this program designed to sop up some of the surplus cash of co-ops.

U. S. MUST LEAD in advancing nuclear technology, according to JCAE chairman Chet Holifield (D., Calif.). He says

that central station atomic power is still "a kind of frontier" since it is not yet competitive with conventional electricity. He thinks that "widespread use of atomic power is inevitable," and that sooner or later "a significant percentage" of U. S. power production will come from nuclear plants. Holifield notes that the question whether more federal aid should be given to develop water-type reactors will have to be faced within the next two years. But, he observes, "we can be sure that additional federal assistance will be required for other than water-type reactors if these types are not to die on the vine." As Holifield sees it, "the important thing" is that the AEC refrain from taking a passive role "and waste time with a policy of 'watch and wait'."

PROTOTYPE ORGANIC POWER REACTOR is contemplated by AEC, which has requested expressions of interest for a 50,000 net electrical kw device, organic cooled and moderated.

RECLAMATION CONTRACT for almost $1.6-million for two 67,000-kw generators for Clear Creek Power Plant, Calif., has been awarded to General Electric. A Japanese firm's apparent low bid of under $1.4-million was rejected as not meeting specifications.

LARGE-SCALE POWER DEVELOPMENT agreements between the Navajo Indian Tribe and the Arizona Public Service Co. have been approved by the Interior Department. One permits the firm to lease for 25 years (with an option to renew) tribal land for steam generation facilities and a reservoir for cooling purposes. The first two units of 175,000-kw each, together with transmission lines and related facilities, will cost about $100-million. Ultimately, cost may go as high as $180-million. The second agreement provides for delivery of power to the Tribe at wholesale rates for redistribution.

AIR POLLUTION SPENDING should be tripled by 1968, an advisory committee to the Surgeon General urges. This would bring air pollution research expenditures to $33-million in 1968. The advisers suggest that the federal government put up 40-percent, industry 28-percent, and state and other governments 32-percent.

ANTI-POLLUTION BILL proposed by Chairman Kerr (D., Okla.) of the Senate's Select Committee on National Water Resources embodies a stepped-up water pollution research program plus added federal aid. Kerr thinks the water pollution problem is "primarily a local responsibility," but adds that "both federal and state governments must provide leadership and assistance." Kerr hopes Congress "will do what is required," without permitting cost to impede action. Rep. Robert Barry (R., N. Y.) thinks that it would speed the cleansing of the nation's waterways if pollution control expenditures were made deductible for income tax purposes. Barry asserts that 9 out of 10 delegates to the National Water Control Conference opposed federal controls over the program.

And, the Public Health Service says it will cost $10.6-billion to clean up the country's rivers, lakes, and streams over the next 10 years. The U. S. Chamber of Commerce would leave anti-pollution action with state and local governments, limiting federal activity to research, and enforcement "only if and when" local governements demonstrate "inability or unwillingness" to act.

LONG-TERM COST of meeting U. S. water demand in most areas over the next 20 years will range from $54-billion to $74-billion in new dams, reservoirs, and waste treatment facilities alone, according to a report prepared for the Senate Select Committee on National Water Resources. Total demand in 1980 is put at an average of 559-billion gallons daily, almost double 1954's usage of 300-billion gallons daily.

ANTITRUST SETTLEMENTS in the electrical equipment suit were hailed by Chairman Kefauver (D., Tenn.) of the Senate Antimonopoly Subcommittee as a demonstration of the effectiveness of public hearings held by his unit. He took issue with the Antitrust Division of the Department of Justice, saying that he did not know why pleas of nolo contendere were permitted in some instances. Kefauver feels that "guilty pleas in all of the cases would have been more beneficial

to the Federal Government, cities, and others who may have been injured by these price-fixing conspiracies."

"COLLUSIVE PRACTICES or any other type of suspect bidding procedure" is to be reported by the contracting officers of the General Services Administration. The data will be given to the Attorney General. Scrutiny will be given to proposals for evidence of "follow-the-leader" pricing, rotated low bids, "or any other bid device intended to deprive the government of the benefit of full and free competition."

INDUSTRY SIFTINGS

DID YOU PAY UNFAIR PRICES? You and all other utilities in the country--private as well as federal, state and municipal agencies--are being asked this big question by a number of the 29 equipment manufacturers whose representatives have been accused of anti-trust law violations occurring in actions "unauthorized" by their management. The manufacturers, including General Electric and Westinghouse, are directing this voluntary investigation to the period 1956-1959.

PRICE DECLINE IN 1960 for appliances and most electrical equipment will extend into 1961, "although improvement is expected in the second half," Westinghouse Pres. Mark W. Cresap, Jr., noted in his year-end statement for the company. Westinghouse 1960 total sales, up a bit from the '59 total of $1.91-billion, should rise further in 1961 (but not to record $2-billion-plus of 1957), he predicts. Westinghouse plans to boost capital expenditures again in '61, to over $60-million; and to help "ease the profit squeeze," will accelerate new product development from the company's research activities. Shipments of generating apparatus--"indicator of volume of deliveries of all types of capital equipment" --should be "up slightly over 1960."

APPLIANCE SALES: UP IN '61--Not one appliance industry leader out of 22 checked by the Institute of Appliance Mfrs. expects less than the '60 sales volume, 15 anticipate increases ranging from 2- to 5-percent . . . and as much as 25-percent on growth items like air conditioning and dishwashers.

"HUMANITARIAN VALUES of accident prevention" are the considerations which make the work of safety directors so commendable, Harold H. Scaff, Ebasco V-P told the executive committee of the National Safety Council's Public Utility Section meeting in N. Y. C. last month. Top utility winner in Ebasco's annual Gold Safety Award "for outstanding employee safety in 1960" is Mississippi P. & L. which achieved a safety record 63-percent better than the rest of the electric utility industry. Other top performances recognized with Ebasco Awards: Louisiana P. & L. Co., the Washington Water Pwr. Co., Chattanooga Gas Co., Western Colorado Pwr. Co., P. S. of Colorado.

OUTSTANDING: 3-POWER PROJECTS were nominated among 11 major engineering projects in the competition to select the Outstanding Civil Engineering Achievement for the 1961 Award of the American Society of Civil Engineers. Competing with newly completed airport facilities, a bridge, a mine, a post office, a bank and a shopping center are: the Niagara Falls Power Development; Dresden Nuclear Power Station (see EL&P Aug. 1, p. 42) and Geysers Power Plant (see EL&P Nov. 15, p. 66).

IN KANSAS: ONE WATER HEATER--Claiming "an unprecedented national first," the Kansas Farm Electrification Council has adopted the 40-gallon quick-recovery electric water heater as standard for the systems of all of the 42 power suppliers of Kansas. Asserting that this heater meets all requirements for more than 95-percent of all potential users, the Council has notified manufacturers and distributors of its decision to "encourage and promote only the sale of this heater" . . . opening a "vast new market" . . . and promising "a real boon for inventory-plagued dealers."

n the time it takes you to read this ad, the residential oad in the United States will have grown at least 570 ilowatt hours, based on an estimated increase of 300 illion kwhr for 1961. This growth goes on every inute of every day, as new homes go up and new ppliances are moved in.

The extra 12 percent kva capacity of General Elec- ic's Permalex distribution transformers gives you an conomical way of meeting this load growth. For the cost of a 25-kva transformer, you get the capacity of a 28-kva unit, with the same long transformer life. Let your General Electric Sales Engineer show you how you can absorb your load growth at least cost. General Electric Company, Schenectady, New York. 482-20

Progress Is Our Most Important Product

GENERAL ELECTRIC

Personnel, Politics, Research . . .

Middle West Conference Guides Utility Chiefs

The question management must answer today regarding executive training is not: Should we have a management development program in our company? . . . but: In what directions do we want to move developmental influences we *already have?*

About 100 executives attending the Middle West Service Company's annual year-end conference for top management of utilities were so advised by Melvin Anshen, professor of industrial administration at Carnegie Institute of Technology.

Prof. Anshen described the big challenge to American business as the need to grow more people . . . better people . . . and to grow them faster. He urged his audience to think of such growth, not just in terms of young men, but in terms of men in their '40s, '50s and even in their '60s.

Other speakers in the Middle West conference program included: Francis X. Welch, editor of "Public Utilities Fornightly;" Philip M. Hauser, professor and chairman of the dept. of sociology at the Univ. of Chicago; and Messrs. Gordon L. Hotstetter and Thomas E. DePinto of the Employers' Association of Greater Chicago. Middle West's Ingo Ingenohl and Stanley W. Anderson presented a "Brief Look into Operations Research."

"Population explosion" statistics were projected in some profusion for Middle West's conference by Chicago University Professor Philip M. Hauser (at left), shown with Middle West's Pres. R. McClanahan, V-P Robb Winsborough.

Dr. Anshen noted that there is considerable agreement on the conclusion that business cannot manufacture managerial talent, but we *can* grow it. The best way to develop it is to provide the proper conditions for growth.

Here's what a company can do to help individuals in their development for bigger management responsibilities:

1. By helping him to handle his subordinates better
2. By helping him learn to use his own time better
3. By helping him to participate more effectively in his company organization . . . and in outside activities.

Dr. Anshen named these as the three prime influences on a businessman's development:

1. His job experiences
2. The kind of bosses he works for over the years
3. His own desire to move ahead.

The basic objective of executive development should be: the fundamental growth of the person to his full potential, observes Dr. Anshen. He recommended having *more* than one man in line to replace each key man in the organization. And summing up the problem of bringing along management talent for greater responsibilities this way: "The cream doesn't rise to the top in sufficient quantity" to be able to rely on this source for managers of the future.

In answering questions, the Carnegie professor suggested that costs for adult education should be borne jointly by company and individual; and that executive rotation should not be a "merry-go-'round" process, but that a man should be kept in a

(Continued on page 34)

Electric Heat Key: It Must Be Sold!

The actions of more and more utility companies are demonstrating the extent to which they are aware that *electric heat must be sold.* All-out promotion, dealer backup, installation standards, cost and performance guarantees—these and a number of other weapons are being used with increasing effectiveness in the accelerating effort to win acceptance for electric heat and to gain for this prime loadbuilding service an edge over competitive heating means.

In the competitive home heating market—where it becomes increasingly apparent that, other advantages notwithstanding, electric heat must hold its own in a cost comparison—the economics factor is being met headon. At least, some aggressive utility companies are showing the way to remove the handicap of doubts and disadvantages largely associated with an earlier market image.

Newest approach in the field of cost assurances (as yet unannounced, in fact) is the plan of an Eastern utility to itself guarantee residential heating installations with the support of insurance protection. And, this plan involves a flat cost figure . . . with no condition relative to degree-days, etc.

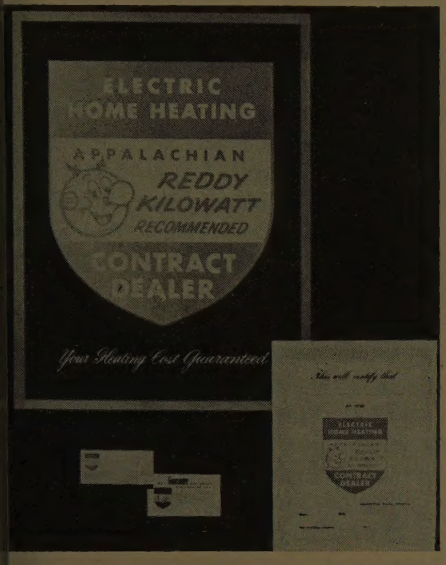
Another utility's plan has lined up "responsible" dealers to guarantee costs within ten-percent of their own estimates. Over 50 "reliable electric home heating dealers are already implementing this plan, operating as "Reddy Kilowatt Recommended Electric Home Heating Contract Dealers" in the territory of Appalachian Power Co., a non-merchandising component of the American Electric Power System.

Appalachian's program is designed as a cooperative effort between the power company and all electri

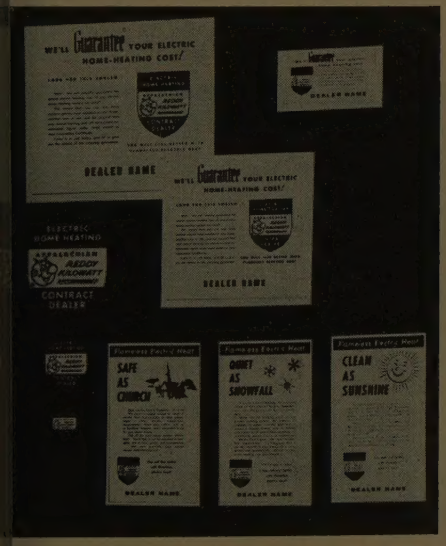
home heating dealers "who can qualify to increase electric heating sales in the area and to meet strong competition from other fuels." Before dealers are eligible to participate in the program, which was introduced in September, dealers must agree to 10 prerequisites listed in a written contract.

Under the program, Appalachian agrees to advertise extensively to promote electric home heating and the Appalachian Reddy Kilowatt Recommended Dealers. The company's advertising does not favor any particular dealer or type of electric heating system but promotes to the consumer the advantages of dealing with Appalachian Reddy Kilowatt Recommended Dealers. The company makes display space available in its lobbies and offices for these dealers and directs prospects to them.

A Residential Electric Heating Show, sponsored recently by Public Service Electric & Gas Co. in the utility's own auditorium in Newark, N. J., drew about 1400 tradesmen. The utility reports that several distributorships were awarded in booths like the one at the right. Public Service feels that "bringing together the manufacturers, distributors and electrical contractors helps to keep the public informed of the convenience of the use of electricity for auxiliary and supplemental heating in homes."



Dealer "tools" and insignia for Appalachian Power Co.'s "Contract Dealer" program identify the utility-dealer relationship.



Dealer ads promoting the Recommended Electric Home Heating Contract Dealer Program of the Appalachian Power Co. Utility advertising supports the dealer sales efforts, too, or course.

The company furnishes to each Appalachian Reddy Kilowatt Recommended Dealer identification cards for his sales people, decals for windows or store fronts, certificate showing that the dealer is affiliated with the program, newspaper mats, annual electric heating cost guarantee certificates, proposal folders for use in making effective sales presentations to prospects, and special incentives for dealer salesmen working in the existing market.

L. L. Koontz, Appalachian system residential and rural sales supervisor, points out the importance of developing the existing home market for electric heating. He notes that at present about 30-percent of the installations being made in Appalachian's area are conversion installations and that more attention is being given to this existing home market, due to the fact that there is a slackening in the number of new home starts. Appalachian has agreed to help develop the existing home market with specific programs and promotions for the Reddy Kilowatt Recommended Dealers.

Mr. Koontz says that the newly adopted Contract Dealer Program is one phase of the company's development of this market. This program aims especially at developing prestige dealers from whom existing home owners can buy a complete electric heating installation with full coverage and confidence.

Mr. Koontz reports the program "well received," evaluates it this way:

"It will be several months before the results of the program can be evaluated but already there are indications that Appalachian Reddy Kilowatt Recommended Dealers are getting sales in the existing home heating market, and that their efforts should influence the new home market as well.

"We are adhering closely to our philosophy of working with dealers, distributors and manufacturers in the promotion and sale of electric equipment. The new Appalachian Reddy Kilowatt Recommended Heating Dealer Program is another evidence of our strong belief that there is much value in cooperation and unity of action on the part of the company and dealers in accelerating the acceptance of flameless electric home heating."

A keen interest in electric heat was reported by the Metropolitan Edison Co., which provided the show location for an all-electric exhibit recently in Reading, Pa. The local electrical association sponsored the 4-day event, called "Electarama," which was visited by 35,000.

Middle West—*continued*

spot long enough to master it as a manager.

Mr. Welch warned that, while dollar devaluation in the United States is quite generally regarded as unlikely, utility people would do well to give it some thought. My only suggestion, said Mr. Welch, is this: Be prepared to work closely and quickly with your regulatory commissions on planned for rate revisions, should devaluation occur.

"Public utility companies cannot look for very much cheaper financing in the year ahead," advised Mr. Welch. "Despite inflationary pressures, the insistence of regulatory bodies on adhering to cost base rate valuations and on using cost of money as the main if not sole gauge in fixing the return allowance is not going to make rate increases very easy to obtain.

"But the fact is that in the case of utilities all indications point to a continuation of a high plant growth rate. Indeed, the utilities may provide the major share of industrial plant increase in 1961 as compared with other businesses which have already leveled off and some of which will probably trend downward. The need of more and more financing to take care of such growth will require that regulatory authorities take a realistic attitude on rate relief. It is possible that more of the state commissions, with or without the insistence of their state appellate courts, will be constrained to give more thought to present fair value in the rate base, or year-end valuations, or higher return allowances, in order to attract the necessary capital to keep these essential services going. I think utilities will get rate relief in 1961, but not as much as they need."

Concluded Mr. Welch: The year 1961 will be a good one as far as public utility operations are concerned.

Phillip M. Hauser, presented extensive material on population trends and their effect on utility operations. Some of his observations follow, in brief:

"The 28-million population gain in the fifties was not evenly distributed throughout the country and, therefore, should be noted by utility executives. More than 60-percent of the increase was accounted for by eight states, each of which gained over 1-million persons in the fifties.

"Even more dramatic than the national resurgence in total population growth is the trend towards the increased concentration of the American people in a relatively small number of metropolitan areas. According to the 1960 Census returns about 112-million persons lived in 211 Standard Metropolitan Statistical areas (SMSA's) on April 1, 1960," said Prof. Hauser.

Said Gordon L. Hostetter, president of The Employers Association of Greater Chicago: "Our American system of free competitive enterprise is dying a slow but sure death. It is slowly giving way to a system of government control of the means of production.

Mr. Hostetter said that busines has the potential to provide th country with a counterbalance bu lacks unity and is therefor impotent.

Operations Research, accordin to Middle West's Stanley W. Ande son, can be of very great value to business organization. It is an at tempt to provide a scientific basi for decision making, with a sub sequent improvement in their qual ity. The companies now making us of its techniques including some o the largest and best known in th country, report that returns fron its use have been tremendous. Suc returns may also be realized b other companies not using it, h proposed.

According to Dr. Anderson, Op erations Research gives precise in formation on which decisions ma be based and it may be used to ob tain the dollar difference in cost o profit between the result of usin "O.R." as contrasted to not usin "O.R." In business, Operations Re search has found many uses. Op timum product mixes, plant loca tions, warehouse and service cente locations, production schedules economic dispatching of generation optimum natural gas demands, fue budgets, and many other simila and non-similar problems hav been solved by its techniques.

Middle West Service Compan reports it makes use of these tech niques and has been carrying out considerable volume of work alon these lines. The consulting firn noted that their experience is avail able to all their clients.

At Middle West Service Company's recent year-end conference for utility executives, speakers Melvin Anshen of Carnegie Institute (at left) and Francis X. Welch, editor of "Public Utilities Fortnightly" (at right) discuss program ideas with Middle West's Pres. R. McClanahan.

"Operations Research" techniques being utilized by Middle West we described by Stanley W. Anderson, shown (at right) reviewing a proje being carried out with Southwestern Electric Power Co. With him a Middle West's W. D. Brown and Southwestern's Pres. J. R. Welsh.

BY RALPH ELLIOTT
WASHINGTON EDITOR

Federal Regulatory Reform

No major revamping of the basic organization and procedures of the federal regulatory agencies is in immediate prospect, despite all the recent ruckus raised about the urgent need for sweeping changes in that area.

True, regulatory reform is somewhere in the offing. President-elect Kennedy, many influential members of Congress, and various organizations of practitioners see a need for it. The incoming administration will push hard for it. But substantial changes will be slow in coming, mainly for two reasons: (1) Considerably more study of the problem is generally recognized as a prerequisite. (2) Changes requiring legislative action will be slowed down by friction between Kennedy and Congress over the question of maintaining the independence of the regulatory agencies.

Among those who will be in the forefront of the regulatory revolution, there is unanimity as to the main goal to be achieved: increased efficiency, and reduction of the massive backlog of cases built up in some of the agencies, resulting in costly delays to both the government and the regulated industries. Various means being proposed toward this end come principally within the areas of procedural streamlining and the improvement, through more careful screening, of agency top personnel—commissioners, administrative officers, trial examiners, and the heads of legal, engineering and accounting divisions. To attract people of higher caliber to the key jobs, an attempt will be made to raise salaries and possibly to lengthen the terms of commissioners.

Also part of the regulatory reform blueprints now taking shape is the establishment of a strict code of ethics to discourage improper attempts to influence the regulators.

But beyond these reform goals, the President-elect wants something else: a much broader than traditional White House control over the agencies. And he can be expected to move early in that direction. Definitive legislative proposals will come later. Such proposals will be built around the recommendations of his chief advisor in the field—James M. Landis, former Harvard Law School dean who served as a top federal regulator during the New Deal era of the 1930's.

The agency overhaul planned by Landis envisions, long-range, a progressive tightening of Executive control within the federal regulatory framework; also the firm establishment of a clearly defined federal regulatory policy. But the overall program will require considerable legislative action, including changes in the Administrative Procedure Act and the specific laws governing each agency's operations.

Whether Congress will be willing to bow to many of the Kennedy wishes is doubtful. The legislators have consistently maintained that the regulatory agencies were created as "arms of Congress," accountable to Congress, and "independent" of Executive control. And although a lot of lawmakers will admit that many of the shortcomings that have developed in the field have stemmed from lack of authoritative surveillance, few will concede that a workable solution to the problem lies in shifting responsibility for proper agency functioning from Capitol Hill to the White House.

A likely prospect for the immediate future is that Congress will work toward some form of tighter Legislative-Executive control over the agencies, without relinquishing basic Congressional prerogatives in the area.

Meanwhile, Kennedy can be expected to make full use of his appointive powers to bring about sympathy with his views that more stringent control of the affairs of regulated industries is called for. He has already made it plain he thinks consumers need a better break, and has said that "If we are to keep the cost of living in line and protect the interests of consumers, then those agencies which regulate the cost of public services must be dedicated to their mission."

Needless to say, fair regulation stands to suffer when political overemphasis is directed to "consumer protection."

Since many members of the "big six" regulatory agencies are serving under recess appointments which may be withdrawn, Kennedy will have immediately available far more than usual power in the appointment process. One example: he can name two Federal Power Commission members to fill an existing vacancy and replace a recess appointment (Paul Sweeney); and can name another member, for a working majority, when Arthur Kline's term ends next June.

In addition to his appointive powers, Kennedy will be able to exercise weighty influence over agency operations through his Budget Bureau, which can reduce or increase an agency's money requests to the administration's advantage.

Of the many and varied regulatory reform proposals that will be cropping up in the weeks and months ahead, those aimed at making the agencies more responsible to the White House will bear the closest watching. Landis, chief architect of the Kennedy strategy, is a strong advocate of the responsibility shift. His reason: "The broad policy pursued by the agencies should fall in line with that of the administration as a whole."

Editor's Note: Another observer of the Washington scene, Francis X. Welch, editor of "Public Utilities Fortnightly," told a recent utility executives' conference (see opposite page) that Congressional investigations have stirred up enough in the past few years so that the area of regulation cannot be ignored in the coming months. The problem: To avoid hurting independence of the commissions, he said.

In 1960 the more important regulatory decisions dealt with the treatment of liberalized depreciation. On the other hand rate increases were relatively small and no outstanding findings of fair value were made for electric companies. However, there was a strong inference in an Illinois Supreme Court decision that perhaps economic depreciation merits consideration where a finding of fair value is required by law.

In the field of liberalized depreciation the trend to the use of actual taxes has continued, although the Georgia Commission ruled for normalization. The Arizona Commission has permitted the inclusion of an automatic adjustment clause for Federal and State Income Taxes.

Rate Proceedings

Illinois Court Affirms Fair Value

The background of this proceeding was the matter of increased rates which the Illinois Commerce Commission granted to the Alton Water Company. The last petition of the Company to the ICC proposed an increase in rates of 50-percent. This was granted by the ICC, whereupon the City of Alton took the case to the District Court of Madison County, which set it aside upon review. The Company and the Commission then took it on appeal to the Supreme Court.

In dealing with depreciation, one of the principal items in dispute, the Court noted in part that: "Although the straight-line method of computing depreciation is widely accepted, it is only an accounting technique for allocating the cost of fixed assets over the life of the assets. It is not a measure of the actual deterioration of property. (United Railway & Electric Co. of Baltimore v. West, 280 U. S. 334, 262, 74 L, ed. 390 [1930].) For rate proceedings in which fair value is a controlling factor, a determination of depreciation by inspection may be preferable to accounting computations, and certainly is an acceptable method. (See McCardle v. Indianapolis Water Co., 272 U. S. 400, 71 L. ed. 316 [1926].)"

The above citation of United Railway v. West is of considerable importance. The Supreme Court of the United States in that case is discussing the annual depreciation accrual, reversed the Maryland Commission which had based such accruals upon cost. The Court noted in part that: "The amount set aside periodically for this purpose (i.e., the restoration of property) is the so-called depreciation allowance. Manifestly, this allowance cannot be limited by the original cost, because if values have advanced, the allowance is not sufficient to maintain the level of efficiency. The utility 'is entitled to see that from earnings the value of the property invested is kept unimpaired, so that at the end of any given term of years the original investment remains as it was at the beginning.' Knoxville v. Knoxville Water Co. (1909) 212 U. S. 1, 13, 14, 53 L. ed. 371, 29 Sup. Ct. Rep. 148."

The Court also noted significantly that: "It is th settled rule of this court that the rate base is presen value, and it would be wholly illogical to adopt different rule for depreciation."

It would appear inferentially at least that the Illinoi Supreme Court is opening the door for future Com mission action to allow economic depreciation in th cost of service.

Interestingly enough the Court reversed the Com mission on the treatment of Section 167 (the Com mission having prescribed normalization of taxes and then in turn it reversed itself in a subsequen Order to reaffirm the Commission's original position

Pacific Pwr. & Lgt. Co. Wins Rate Hike

While the Company received a rate increase whic was 76-percent of the amount originally requested the Commission gave no recognition to any elemen of fair value and in fact went out of its way to attac the whole concept.

The staff's position with respect to a fair valu rate base is to the effect that its determination " . . *is impractical. in that it is cumbersome, time consum ing, expensive, difficult to check as to accuracy an soon obsolete; that utilities operating in this stat and the State of Washington, where no weight ha been given to present value in the determination o the rate base, have succeeded in attracting severa hundred million dollars of capital, both debt an common equity."**

The attraction of capital theory is a myth which ha long since been exploded under the impact of con tinuing inflation and the lack of relevance which th current cost of money theory bears to the require earning needs of an individual utility.

Because of inflation the utility industry has in voluntarily paid dividends out of capital since it annual depreciation accruals, based as they are o original cost, cannot maintain its property intac To the extent that such earnings are overstated, thei attractiveness in the stock market are overstated, an because of that the attraction of capital theory fail to meet the test of equity to the existing owners the property.

The Commission did not deduct the restricte earned surplus arising from the use of Necessit Certificates. It allowed a rate of return of 6.1-percen on a 1959 net original cost rate base of which eigh months were actual and four months were estimate

Pacific's request for a rate increase in Washingto was denied. In addition the Commission refused t give any recognition to fair value in the rate base.

Two Commissions Raise W. W. P. Co. Rates

The Washington Commission granted 72-percent the increase proposed by the company, while in th Idaho jurisdiction the company obtained 90-percen

*Italics supplied

of the amount originally requested.

In both instances the Commission gave no consideration to elements of fair value. In fact the Washington Order in this respect sounds like a mere paraphrasing of the Oregon decision. For reasons which are not clearly explained, the Commission allowed Washington Water Power Co. to include Account 100.5 in the rate base, but denied comparable treatment to Pacific Power & Light.

It is of interest to note that the Commission allowed a forward rate base of net plant in service as of June 30, 1961, and in addition did not deduct the restricted surplus arising from the use of Necessity Certificates under Section 168. This is unquestionably a step in the right direction and one which other jurisdictions should consider.

The Commission allowed the company a rate of return of 5.9-percent instead of the 6.25-percent to 6.4-percent originally requested.

P. S. Gas & Elect. Hikes Rates $10-Million

In this proceeding the New Jersey Commission refused to give any weight to fair value in determining the rate base, but noted that attrition due to inflation would be given consideration by presumably increasing the allowable rate of return. This the Commission set at 6.25-percent on a year end original cost rate base.

It is also significant that the Commission denied the Company a six-month forward rate base which it had granted several years ago to the New Jersey Bell Telephone Company. Presumably, the repercussions which followed that case were such as to make the Commission decide that it was best to "let sleeping dogs lie."

Developments in Depreciation and Taxation

In a recent rate proceeding before the Arizona Corporation Commission, the Arizona Public Service Co. asked for three automatic adjustment clauses. The Commission's Order noted that:

"The Applicant has had adjustment clauses for changes in excise tax rates, boiler fuel costs and the cost of gas purchased for resale. In its application, however, the Applicant asked for additional adjustment clauses for:

(1) Any changes in the wage rates or classifications of assigned operating labor from that used after June 30, 1959.

(2) Any changes in the tax rate or method of computation for Federal income tax or State income tax from that used in the return filed by the Applicant for the calendar year 1958.

(3) Any changes in the tax rate or method of computation for ad valorem tax from that in effect for the Applicant during the calendar year of 1959, or for the possible future imposition of any new taxes."

While the Commission granted the automatic adjustment clauses under (2) and (3) above, subject to a ruling by the State Supreme Court that such clauses were legal and within the power of the Commission to grant, the Commission denied the Labor adjustment clause on the grounds that such an automatic adjustment would make the company less diligent in resisting wage increases. It is believed that the automatic tax adjustment clauses are the first in the history of regulation.

California: Liberalized Depreciation

The California Public Utilities Commission ruled in a 3 to 2 decision that utilities under its jurisdiction who availed themselves of the provisions of Section 167 of the Internal Revenue Code of 1954 will only be permitted to use actual taxes, and that no normalization would be allowed.

The Commission noted that a number of witnesses took the position that not only was there a future tax liability, but that with the normalization and use of the tax reserve for accumulation of such deferrals, the ratepayers will not bear the additional cost of higher taxes when they occur. In this connection the Commission said: *"It may be conceded that there is logical argument to support (such a) view, if one looks at this matter purely from the standpoint of accounting theory.* However, this is a subject which must be viewed as an overall proposition."

It would appear that the California Commission which has always been wedded to the accounting theory of rate making has now decided to discard it, since it did not fit its preconceived notions of the end result that was desired on the grounds that such " . . . considerations . . . did not lend themselves to abstract theory or barren logic."

The Commission then gave the standard and erroneous argument that because of growth of the California utilities the deferral of taxes will become permanent, and hence the normalization of taxes could not be used since that would be contrary to the Galveston decision of the U. S. Supreme Court.

The Commission was seemingly in error when it said: "Wherever the matter of normalization of income taxes, based upon Section 167, has come before the courts, the normalization theory has been rejected."

It should be noted that the Illinois Supreme Court in the case of the Alton Water Company reversed itself and sustained the Illinois Commerce Commission's position on normalization, while on June 5, 1959, the Indiana Supreme Court upheld the normalization of taxes for rate making purposes in the case of the Public Service Commission of Indiana.

SEC Issues Regulations on Tax Deferrals

In its statement of Administrative Policy the SEC ruled that any utility that normalizes taxes arising from the use of Sections 167 and 168 of the Internal Revenue Code of 1954 must use a reserve method of

accounting on the Balance Sheet.

The question that might well be asked here is just how many different types of reports will a company have to make that is regulated both by a State regulatory commission and the SEC. There would appear to be enough accounting problems between State and Federal jurisdictions without adding any new ones.

Another major problem which the foregoing decision raises, assuming the SEC is sustained in the Courts, is the ultimate disposition of amounts currently lodged in restricted or appropriated surplus which were considered as part of earned surplus in the issuance of new securities.

Furthermore, the SEC ruling may have pushed the utility industry further down the road towards the use of the "flow-through" method than it suspects. Since utility companies currently using actual taxes are not subject to the normalization provisions of the SEC, it is conceivable that utilities which are now normalizing taxes and using either a restricted or appropriated surplus may well decide to switch to the flow-through method. This would be done in the hopes that for rate making purposes their State Commissions will permit earnings which would leave their own surplus position unchanged.

Such regulatory conflicts and uncertainties can be detrimental not only to investors and customers, but also to the public interest at large.

Ohio P.U.C.: C. G. & E. to Use Actual Taxes

This Order was the result of a rehearing on an earlier application by the Company for a rate increase in the amount of $2,238,000. The first order issued by the PUC on April 15, 1960, reduced the Company's request by 30-percent. The rehearing on the treatment of taxes under Section 167 reduced the above amount by another 30-percent, or an allowed increase of only $879,000.

In its original Findings and Order the PUC gave tentative approval to the Company to normalize taxes arising from the use of Section 167, but in so doing it noted that " . . . it neither accepted the characterization of the reduction in tax liability as a 'deferral' nor attempted to establish a policy in the matter."

Seemingly this uncertainty prompted the Company to petition for a rehearing on the grunds that " . . . the Commission erred in failing to determine as a matter of fixed policy that the tax advantage offered by the use of accelerated depreciation would accrue 'to taxpayers such as Applicant herein, as distinguished from Applicant's customers.' "

The Commission, after noting that all utilities in the State of Ohio had exhibited substantial growth in the past, and that Cincinnati Gas & Electric Company specifically had doubled its electric load, and tripled its gas load while spending some $280-million since 1947, was no exception to this rule. Consequently the Order noted:

"The record in this proceeding makes it clear that this Company will continue to make new additions. Further, it indicates that new additions will be made at a rate far in excess of that necessary to offset lesser amounts of depreciation deductions taken for older assets. Our experience indicates that this will be true in general of utilities in this State. In these circumstances and in view of the convincing testimony of Dr. Eisner, we must reject the theory that a deferral of tax liability arises from the use of accelerated depreciation, and consequently must reject normalization of taxes for rate making purposes; no such deferral exists and no such liability will arise. We will allow only the expense incurred, that is, the federal income tax *actually paid* by the Company. *It is our opinion that this treatment will benefit both the ratepayer and the utility.*"*

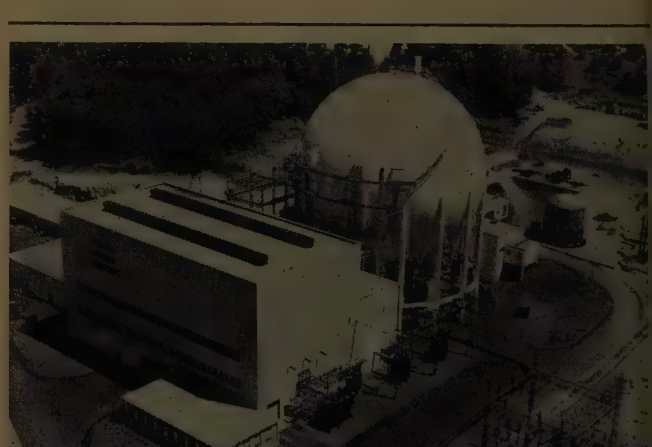
Georgia P.C.S. Orders Normalized Taxes

The foregoing contention of the Ohio Commission was challenged by the Georgia PSC when it ruled on an application by the Georgia Power Co. to have taxes normalized. In this proceeding, the Georgia PSC referred to the testimony of Herman W. Boozer, vice-president in charge of finance for the Georgia Power Company, as follows:

"He stated that if Georgia Power Company had to replace the $30,000,000 of interest-free funds presently available from deferred income taxes, with a like amount of regular securities, the Company's rate of return would decline by four-tenths of a percent; and, inevitably, even if not immediately, Georgia Power Company would have to seek increased rates to provide additional revenue to cover the capital charge on this $30,000,000. Witness further stated that under present money market conditions such added financing would require $2,100,000 for return, plus an additional $1,500,000 for income taxes or a total of $3,600,000 more each year from the ratepayers."

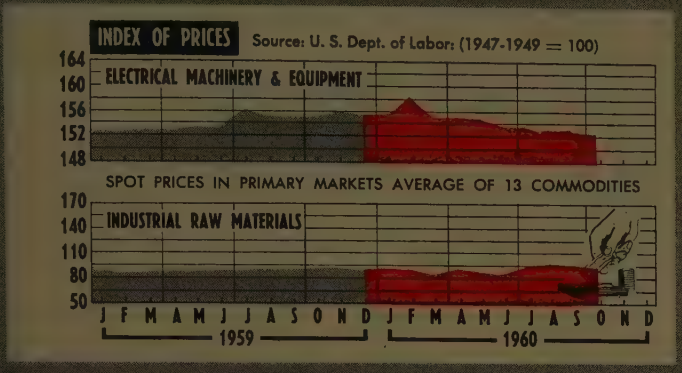
The Georgia Commission came to the conclusion that taxes arising from Section 167 are deferred, and consequently permitted normalization both for accounting and for rate making purposes.

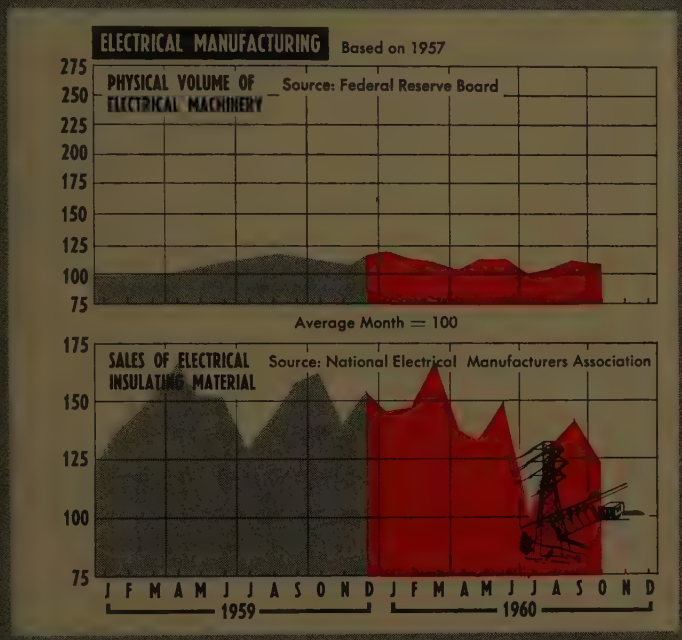
*Italics supplied

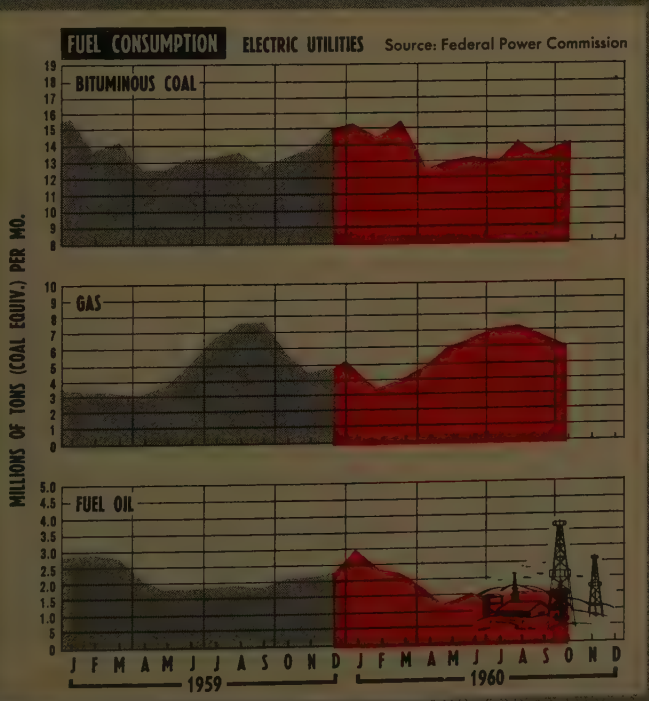


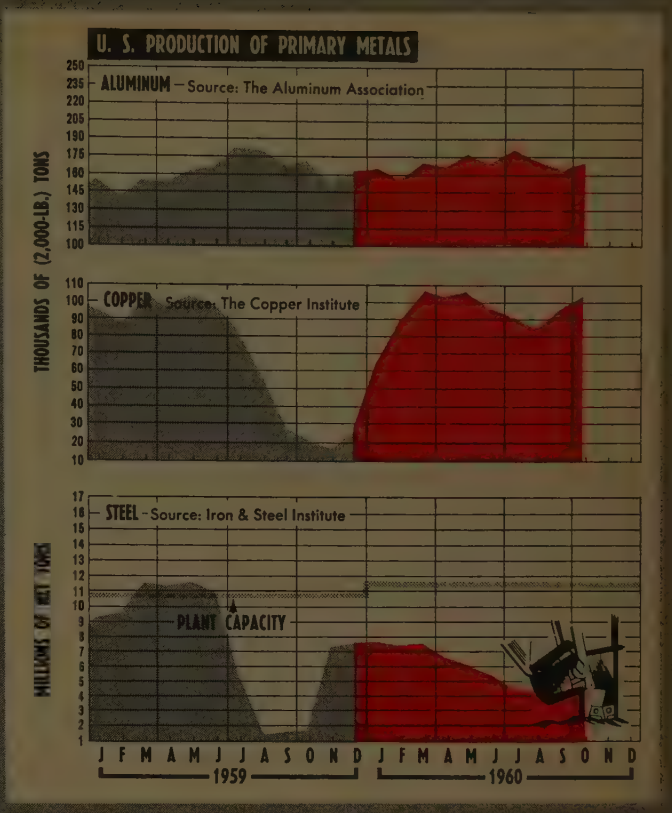
Yankee atomic plant is operating near its capacity of 136,000-kw; over 100,000-kw at year's end. Meanwhile, Yankee Atomic Elect. Co. officials asked the AEC for an ok to effect minor changes in the reactor without specific prior approval of the Commission. In a public hearing held by the AEC last month, "the scope of technical specifications" in Yankee's license was considered. Yankee's original license authority limited reactor operation to 110-megawatts electrical, with the company required to report to the Commission after 500 hours of operation at this level, or six months after license issuance date.

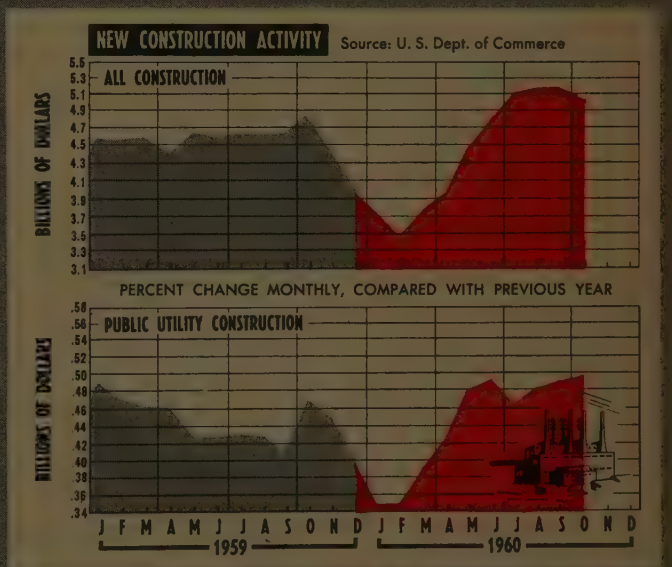
MARKETING GUIDEPOSTS

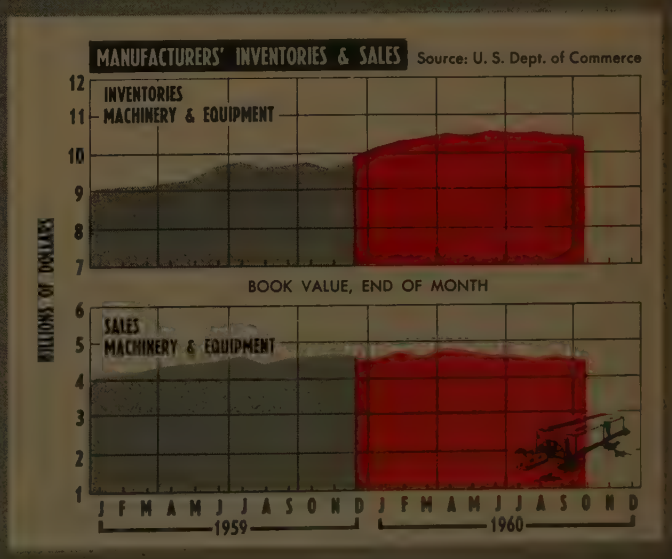












SUPERHEAT DEVELOPMENT PROGRAM aiming at the eventual construction of a large (300- to 400-megawatt) atomic-electric generating station is being built around "the world's first separate superheat reactor, which will be used as an engineering tool to develop superheat reactor fuel." Seven New York State utilities are participating, through a non-profit corporation—the Empire State Atomic Development Associates, Inc. (ESADA)—to the tune of $5.75-million. General Electric will design, build and own the developmental reactor, operating it at San Jose, Cal., next to the Vallecitos Boiling Water Reactor . . . raising the temperature of steam produced in the VBWR to levels achieved in conventional steam generating stations of modern design.

SHUTDOWN OF DRESDEN since Nov. 15, to correct a problem involving the mechanism which operates the reactor control rods, was to have extended into the new year. The action was taken after a 27-day continuous run from the official startup following the plant dedication on Oct. 12. One of the reactor's 80 control rods appeared to have been separated from its drive mechanism. Suspected was a severed drive tube, caused by stress corrosion cracking of stainless steel used in the tube. One advantage in the unscheduled shutdown: construction cleanup work, scheduled to be done at a later shutdown, has not been completed in the current period.

PLUTONIUM FOR COMMERCIAL USE is being distributed by the AEC at base charges established at levels equal to the fair prices ($30-$45/gram) which the Commission will pay for this material.

GAS-COOLED REACTOR EXPERIMENT of AEC has operated with a second core at design power of 2,000-thermal kw. It will produce 300-500-kw of electricity for a full year with pin-type fuel elements. It is scheduled for test operation next summer at the National Reactor Testing Station.

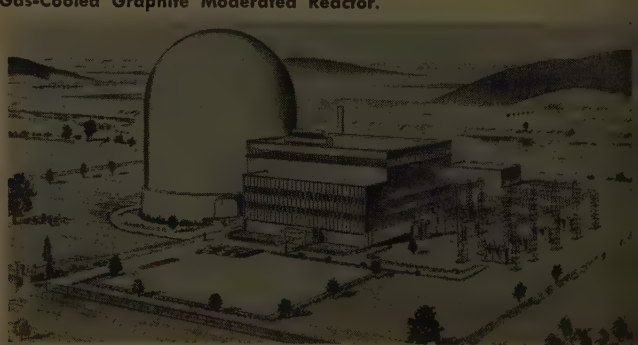
Progress at San Diego facilities of General Atomic—where the General Dynamics Division is conducting a broad program of research aimed at developing devices for the direct conversion of heat to electricity—is viewed by officials of the Rocky Mt.-Pacific Nuclear Research Group. Shown inspecting an experimental high temperature cesium cell, with General Atomic's R. W. Pidd and R. A. Missman (at left), are: Messrs. O. E. Walsh, H. C. Heffelman, Elton Buell, L. R. Patterson, C. E. Cannon, Paul A. Blanchard, H. S. Johnson, E. R. de Luccia, A. A. Lingo, Geo. Beard, J. B. Beard, J. B. Ward and F. M. Warren, Jr.

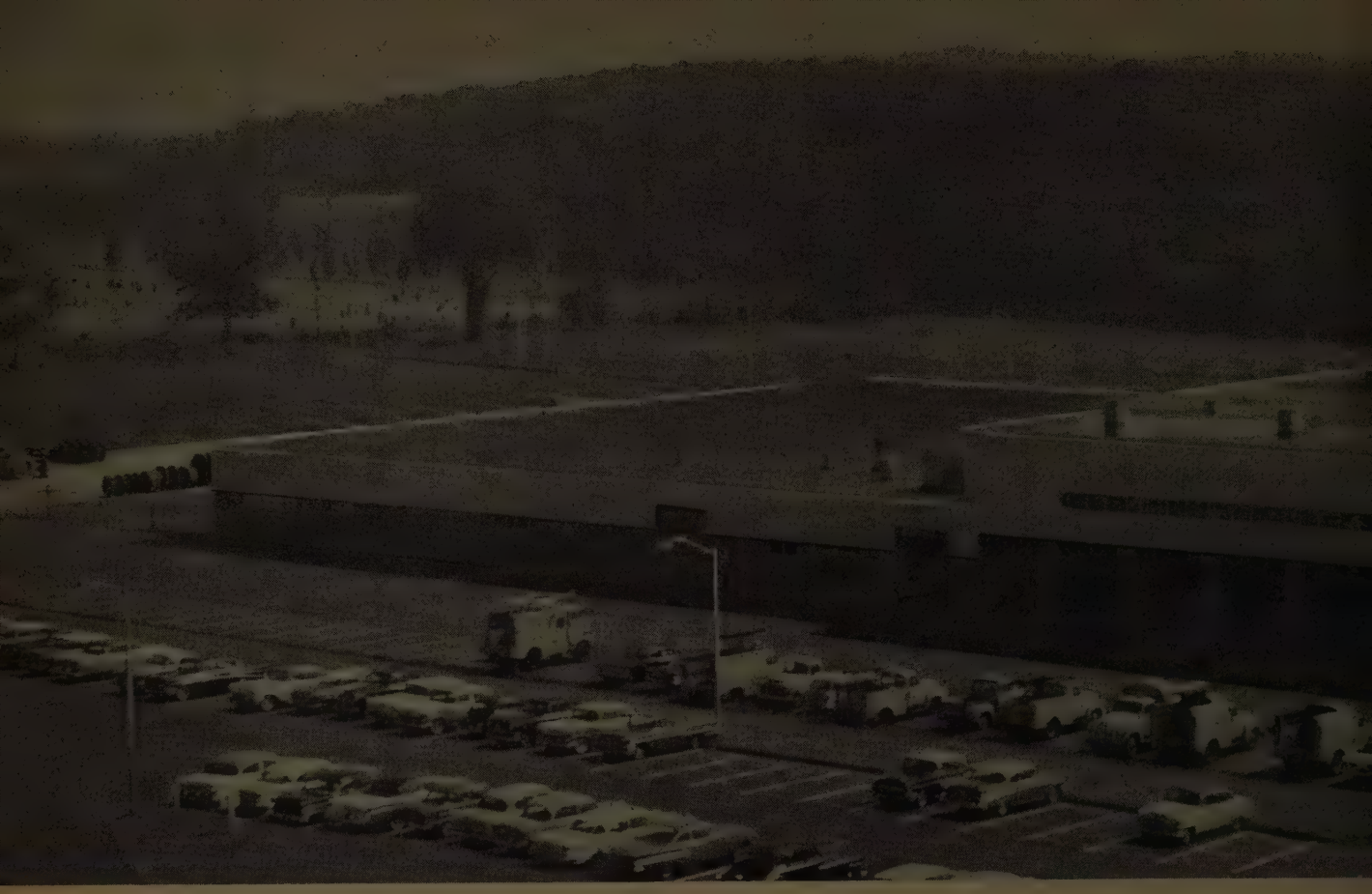
Experimental Gas-Cooled Reactor—a combined experimental and demonstration reactor with a steam power plant producing 22-megawatts of net electrical power—is shown in an early construction stage. The EGCR is being designed and built for the AEC, at the Commission's Oak Ridge site. Kaiser Engineers has the prime design contract, Allis-Chalmers is the nuclear design subcontractor, ORNL is designing control rods and fuel elements and H. K. Ferguson Co. has the prime construction contract.

AEC-OWNED POWER REACTORS, installed at non-AEC sites as part of conventional electric power systems, the Commission proposed recently, will be handled in matters involving safety considerations with the same procedures as those observed in licensing power reactors which are privately owned. Thus, the new policy extends to the public the same opportunity to participate in safety review of all power demonstration reactors.

PERSONAL RADIATION MONITOR (PRM) is a new type radiation protection instrument recently developed at the Oak Ridge National Laboratory. Unlike previous radiation monitoring devices used by individuals, this one indicates whether user is entering or leaving a dangerous radiation area. Also, in a radiation accident, the new type monitor gives an immediate warning. About the size of a fountain pen, and worn in the pocket it weighs only 3½ ounces. PRM emits a warning tone and flashes a small neon lamp in the presence of a gamma radiation field, both the warning tone pitch and the flashing rate of the lamp increasing with radiation intensity.

The high temperature gas-cooled nuclear power plant in the 300,000 to 500,000-kilowatt size range on which work will be carried out under a joint program of General Dynamics' General Atomic Division and Empire State Atomic Development Associates, Inc. (ESADA) is shown in an artist's conception. On Jan. 17-18 General Atomic is host to AEC access permittees for a conference on the High Temperature Gas-Cooled Graphite Moderated Reactor.





NEW CENTRAL WAREHOUSE SAVES CL&P $300,000 ANNUALLY

Economical volume purchases are made through greater standardization of materials made possible by new central warehouse facility. Better stock control reduces over-all inventory $1-Million. Palletized handling cuts loading time from hours to minutes.

By FRANK M. REINHOLD,
Vice President, Purchasing
The Connecticut Light & Power Company

A new central warehouse at Berlin has saved the Connecticut Light & Power Company $150,000 the first six months of operation through the volume purchases it has made possible. And it is expected that annual savings of $300,000 will be realized.

By greater standardization of materials and purchasing in truckload lots, CL&P can obtain substantially lower costs than heretofore. Although some of these lowered costs are consumed in handling and redistribution to the Company districts, the savings realized are still sizable.

Central Location

The site on the Berlin property was the ideal location, since 80% of the materials are used within a 25-mile radius. The central warehouse is set up to handle about 1000 standard fast-moving electrical items, representing 85 to 95% of the total dollars spent annually for materials.

Left, new central warehouse, adjacent to company's Berlin headquarters building, is located at the center of a 25-mile-radius circle in which 80% of materials are used.

Below, warehouse area is only one-third under roof. Another third has a roof but no siding and final third is a concrete pad only.

Designed and built to be strictly utilitarian, the over-all storage facility totals 100,000 sq ft. A third of it is enclosed and heated; another third has a roof, but no siding, and the final third is a concrete pad only for heavy apparatus and cable. Inside the building, materials can be stacked to a height of 14 ft.

Modern Materials Handling

To facilitate the handling of material, the whole area has been constructed at proper truck height. Heavy materials are stored on pallets to eliminate physical handling, cutting a 2-hr job of loading or unloading down to 15 min, and the warehouse is equipped with the latest modern materials-handling equipment.

This central storage facility is actually a distributing warehouse for the Company. It is a wholesale operation; material is purchased and delivered by full truck-load lots. And, items are distributed to the districts by standard package lots, once or twice a week by our own large trailer truck or a smaller, van-type truck.

Left, all material is handled quickly and easily in warehouse.

Paperwork Is Cut

The paper work accompanying transfer of materials has also been streamlined. Most of the 1000 items are listed on a preprinted form making it necessary for the district to jot down the quantity only. The form is sent in triplicate to Berlin. One copy goes to the purchasing department; another stays at the warehouse and a third goes back to the district with the order, where it is initialed and then sent to the accounting department at Berlin.

(Continued on next page)

Better Stock Control

The results which have been realized with the central warehouse, even during these few months of operation, are beyond expectations. The establishment of this facility makes it possible for the purchasing department to maintain better control of the stock throughout the Company than has been possible in the past. Consequently, there has been a tremendous reduction in the over-all Company inventory. This is expected to reduce the amount of materials carried in stock by approximately $1-million. Each district still maintains emergency stock. In addition, regular operating stock will be reduced to a two- or three-week requirement. Stock has also been transferred from the heavily-loaded districts back to Berlin or to other districts for prompt use. Today we are well on the way to an inventory turnover of once every four weeks.

Because the Company Districts are supplied with materials on a regular schedule, permitting smaller inventories, present store-room facilities throughout the Company will continue to be adequate for a number of years longer than would otherwise be the case.

This central warehouse could not have been practical ten years ago. It is only because of the recent rapid growth of the Company, the use of large amounts of material and, above all, standardization of these materials, that a central storage facility is possible.

Left, leveling docks on loading platform are adjusted hydraulically to reduce truck loading time.

Below, heavy-duty crane car handles largest cable reels with ease.

Above, material is piled up on pallets to be loaded into truck for distribution to company districts.

Left, company's large trailer truck distributes equipment and material to company districts in standard package lots once or twice a week. A smaller van-type truck is also used.

Line Patrol By Flipper Instead of Foot

A different kind of line patrolman was needed by Consumers Power last summer to inspect its 46-kv cables which pass through the Straits of Mackinac to help Edison Sault serve Michigan's Upper Peninsula. Like their brothers-in-air, the underwater cables need periodic inspection. It was the first inspection time since their installation in 1956.

The underwater inspection, sometimes made in depths of 246 ft, took the services of four men and two boats. Ten working days were needed to cover the relatively short distance of just under four miles. Logan Diving and Salvage Co., Jacksonville, Florida furnished the aquatic patrolmen.

Two engineers plotted the course and position of the cables while the skin divers went to the 90-ft depth mark from both shores, or about two thirds of the total distance. The remaining footage was checked with a magnetic sounding device.

And, at Carolina Power and Light's Tillery hydro project on the Pee Dee River near Mount Gilead, skin divers joined engineers and technicians to install a 30,000-hp generator. As the 75-ton runner was being installed, divers worked at depths down to 85 ft to clear a 32-year accumulation of silt and debris from the intake area to serve the new unit. Gates will be installed to control the flow into the turbine.

Crack Repair Saves $6000

A circuit breaker with a cracked joint between the steel band and insulating procelain was repaired at a cost of about $1.50 thereby saving about $6000 at The Korea Electric Power Co., Ltd. Repaired on September 3, 1959, the breaker is still in operation.

Leaking transformer oil from the joint through which 155 mva was flowing appeared at first to call for an imported replacement part costing $6000. Instead, about three quarters of a pound of Devcon A—a liquid form of Plastic Steel (a modified epoxy made by Devcon Corp., Danvers, Mass.) was applied to the leak. Plastic Steel, composed of 80 percent powered steel and 20 percent plastic, is mixed with hardener just before using. Applied with a putty knife, it cures without heat or pressure into a solid mass that can be machined.

Set Up Condenser Tube Clinic

A condenser tube clinic has been established by Chase Brass & Copper Co., a subsidiary of Kennecott Copper Corp. The clinic, under direction of J. J. Vreeland, will work with various companies on analysis of water, tube failures, corrosion problems and metallurgy.

Companies experiencing problems with tube failure or excessive wear can supply samples that will be studied by Chase specialists in metallurgy and water problems. A utility, for example, can send a sample of failed tube with a description of service conditions, and Chase will work with the company on determining the cause and a means of correction.

Con Ed Tries Ductile Iron Gratings

Consolidated Edison recently installed ductile iron gratings for some of its transformer-vault street vents. The material met the following Con Ed specifications: (1) Corrosion resistance of cast iron, (2) as strong as steel, and (3) a configuration which would assure a consistent fit and thus eliminate noise created by the passing of heavy traffic over the cover.

Placed side-by-side in groups of five, the gratings form the street roof over the transformer manholes. The gratings measure 2 ft by 4 ft 6 in. by 5 in.

Stock Pipe Against Custom-Bored Tube

A special instrument to measure the efficiency of hydroelectric turbines at Niagara Falls, N. Y., features a mercury-filled U-shaped tube with one glass leg and the other made of stainless steel. So critical are the I.D. dimensions that a gunsmith is employed to lap and bore the stainless tube.

Because of the high cost involved and the scarcity of expert gunsmiths, Babcock & Wilcox was asked to submit its stock stainless steel pipe for testing. A short length of Schedule 40, stainless pipe, 0.675 by 0.191 wall, type 304 pipe, was furnished.

It was matched against the glass tube and found that the degree of I.D. uniformity compared so favorably with the specially bored stainless tube that the two could be interchanged without further I.D. machining. Thus, by using this stock material, the heavy cost of special boring could be eliminated. This applied to the whole range of pipe sizes needed from ⅜ in. O.D. up to two in. O.D.

Steel Cantilever Forms On Thin Arch

The first ten-ft lift steel cantilever forms to be used on a thin arch structure will be used in concreting Appalachian Power's Smith Mountain Power Project Upper Dam near Gretna in Southern Virginia.

Specially designed and fabricated by Blaw-Knox Co., the face and bulkhead forms will be used to place 86,000 cu yds of concrete in the 217-ft-high dam. It will be 860 ft wide and rise in thickness from 32 to 9.5 ft. Monoliths will be about 80-ft wide.

NYLON SLINGS GIVE TRIPLE LIFE

By T. J. HARDING
Maintenance Foreman
Muskingum River Plant
Ohio Power Co.
AEP System

Flexibility of nylon sling makes it easy to use. Finished surfaces and fragile parts are protected during handling. There is no need for additional blocking or protection.

SAFE WORKING LOADS (IN POUNDS)

safety factor is 5 to 1

EYE AND EYE AND ENDLESS SLINGS

Sling Width	Choker Hitch	Oval Hitch	Basket Hitch	Oval Hitch 30°	Oval Hitch 45°	Oval Hitch 60°	Basket Hitch 30°	Basket Hitch 45°	Basket Hitch 60°
1"	1350	1800	4000	900	1275	1550	2000	2800	3450
1¾"	1900	2500	5600	1250	1775	2150	2800	3775	4850
3"	1750	2350	5200	1175	1800	2050	2600	3675	4500

REVERSED EYE SLINGS

Sling Width	Choker Hitch	Basket Hitch	30°	45°	60°
2"	1875	5000	2500	3500	4300
3½"	2625	7000	3500	4950	6050
6"	1350	4000	2000	2800	3450
Heavy Duty Double Thick 3½"	5000	13500	6750	9550	11700

Nylon web slings have proved less costly and more versatile than small size wire-rope slings. These are the results of more than two years of comparison tests, which are being continued.

These slings are used in maintenance work for handling many types of equipment and parts too heavy to lift by hand. They are strong enough to handle most turbine parts, except casings and rotors. They offer built-in protection when handling fragile parts with machined surfaces, such as turbine governors. They also aid in lifting easily crushed parts, such as steam leads with insulation around. And protective blocking is not required when lifting structural steel members or other objects with sharp corners.

All of our wire-rope slings of ½-in. diameter or less were first compared with nylon web slings of equivalent load-carrying widths. The widths selected for nylon slings then became 1, 1¾, and 3 in. for eye slings and 2 and 3½ in. for reversed eye slings. These have all been in service for more than two years and still appear to be good for at least another year of service. That will be more than three times the average service life we have experienced with wire-rope slings.

The initial cost of nylon slings varies from 80 percent to 285 percent of the cost of the wire-rope type. However by giving triple the life, the cost of nylon slings is actually 27 percent to 86 percent of the cost of the wire-rope type. In addition, many man-hours are saved by their use. This is because it is unnecessary to block these slings to avoid kinks at sharp bends or to avoid crushing delicate materials such as insulation. Besides these advantages, slings of nylon webbing have other outstanding characteristics, such as:

1. Very high flex-life and resistance to abrasion.
2. High strength combined with low weight.
3. High extensibility with high recovery.
4. Heat and chemical resistance.
5. Low moisture absorption and quick drying.
6. Easily handled and stored.

The safe working loads, supplied by the manufacturer of these slings, are shown in the table. Additional information can be obtained from The Caldwell Company, Inc., Rockford, Ill.

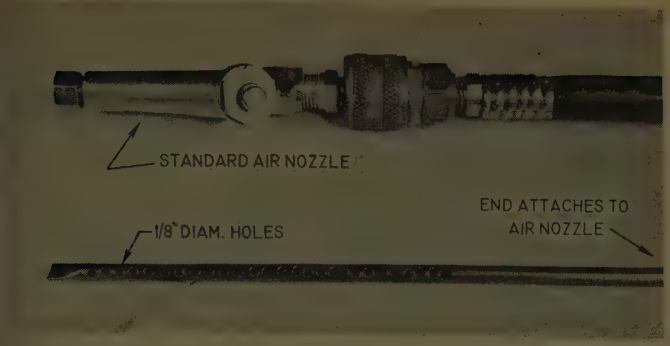
Develop Wire Shielding Process

A new method of metallic tube shielding of electrical wire and cable has been developed by Electrarc, Inc., Boston, Mass. The process starts with the insulated wire to be shielded and lengths of aluminum tape of any desired thickness up to 8000 ft in length. The tape is formed in a continuous process into a tube around the insulated wire. The joint in the tube is then arc welded without injury to the wire insulation.

The welded joint and the tube are then cold-worked until a gas, and water-tight cylindrical tubing which fits closely around the insulated wire is produced.

Wires as small as 0.075 in. diameter, over the insulation, have been shielded with the process, and thought is now being given to application of the process to cables in excess of 3 in. diameter.

Due to the nature of the process, the manufacturer claims it is actually easier to make this shielding with thin walls of less than 0.025 in., and the developers say that wall thickness of 0.007 in. and 0.005 are not only possible but probable.



Vehicle radiators can be cleaned thoroughly and more quickly with this homemade attachment for a garage air nozzle.

Holes in the 3-ft long ¼-in. pipe shoot streams of air through every section of the radio core to drive out all accumulated bugs and debris.

AIR TOOL CLEANS AND DE-BUGS RADIATORS

By G. W. GRIBBLE
Automotive Inspector
Ohio Power Co.
AEP System

A simple homemade attachment to a standard garage air nozzle has solved the problem of cleaning bugs, butterflies, weeds, seeds and other debris from the forward fins of radiators on cars and trucks at the Ohio Power Co., Newark, Ohio. Estimated savings are 15 min for each vehicle cleaned, or about 135 man-hours per year (for cleaning each of the Division's vehicles twice).

Also a better cleaning job is done, because the standard air nozzle formerly used would clean only half of the radiator. That air nozzle could never clean the area covered by the cooling fan because it is usually too close to the radiator.

This cleaning is especially important for line trucks that get out in the fields and off the beaten path. If these foreign substances are allowed to accumulate, the cooling effect of the radiator is impaired and the engines run hotter than necessary, thereby increasing repair bills.

Since the bugs and other foreign material collect on the forward side of the radiator, it is necessary to blow compressed air through from the engine side to clean the radiator core.

To solve this problem, we developed the air-pressure cleaner attachment shown. First we drilled a number of ⅛-in. holes along one side wall of ordinary ¼-in. tubing, 3 ft long. Then one end of this line was crimped shut and soldered. The other end was flanged and fitted with an adapter to our standard air-hose nozzle. By moving this tool back and forth across the radiator a few times, we have been able to blow all debris clear from the radiator to allow free passage of incoming air. Our air system has 150 psi, but less pressure would also do the job. Making the tool required about an hour; the fittings and materials necessary to adapt it to our air gun cost only 65¢.

Develop Reel Standards For Aluminum

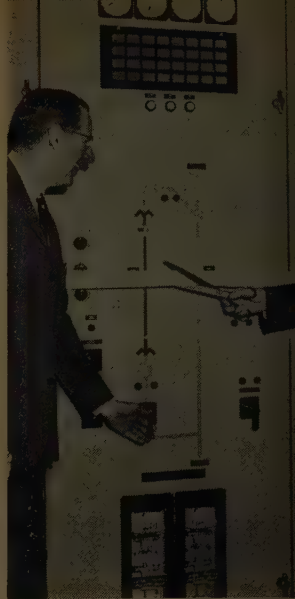
New reel standards have been developed by The Aluminum Association for the packaging of bare aluminum electric conductor. The new standards, which The Association plans to issue on a tentative basis early this year, cover reels of only 12 sizes, but these 12 reels will accommodate all standard types and sizes of both stranded aluminum conductor and ACSR.

The new standards were developed by the Technical Committee of the Association's Electrical Conductor Div. which began work on the project in the fall of 1958. From the beginning, the Committee's objectives have been to formulate standards that would permit maximum economy to both manufacturers and users, and at the same time defer to users' requirements.

Specifically, the new standards provide for the largest possible packages consistent with users' requirements and equipment limitations, and for smaller packages that are even fractions of the largest. The number of reel sizes is held to a minimum, and the cubic capacity of each is utilized to the maximum practical extent. The reel sizes chosen permit maximum use of aluminum stranding spool capacity, and for ACSR the lengths of steel core wire are matched to the lengths of aluminum wires on the stranding spools.

It is not expected that a changeover from present packaging to the new standards can be effected at once or by any fixed future date. The standards are considered, however, as targets toward which both producers and users can orient their planning and operations. It is recognized that users must have an interval in which to consider possible effects of changes in their practices and that producers must have an opportunity to work off existing inventories of reels and supplies stocked for present packaging standards. The Association's Committee is collaborating with Committee B-1 on Wires for Electrical Conductors of the American Society for Testing Materials toward bringing the ASTM specifications for aluminum conductor and the new Aluminum Association standards into conformity.

North substation of G-E's 750-kv Project EHV viewed from portal transmission tower No. 1. Western Massachusetts Electric's 115-kv supply enters the substation at the rear. At right is headquarters building, containing data collection and control rooms.



H. J. Cadwell (left), president of Massachusetts Electric Co., actuates regulator to step up voltage on Project EHV's 750-kv line while R. L. Gibson, vice-president and general manager of G-E's Transformer Division, cuts the symbolic ribbon to open the project.

ENERGIZATION OF 750-KV PROJECT EHV MARKS MILESTONE IN TRANSMISSION RESEARCH

EXTRA-high-voltage transmission research took an important step forward on Dec. 8 when H. J. Cadwell, president of Western Massachusetts Electric Company, actuated the 40,000-kva regulating transformer which brought up voltage on the north section of G-E's 750-kv prototype transmission project near Pittsfield, Mass.

The south section is due for completion in mid-1961. Beginning in late 1963 the complete Project EHV link will be operated by Western Massachusetts Electric as an integral part of their system to supply Pittsfield.

To what extent nuclear-power generation and EHV power transmission can emancipate New England from its fuel disadvantages cannot now be predicted with accuracy, Mr. Caldwell said, but his company's long-range planners eagerly await the outcome of EHV research.

Participating in the ceremonies, L. H. Roddis, Jr., president, Pennsylvania Electric Company, discussed what EHV transmission means to a utility and told of experience gained with Penelec's 13-mile 460-kv line now operating as a part of the GPU network. "We believe," he said, "that the ability to transmit large blocks of power greater distances—even across the the country by displacement—offers possibilities of important economic benefits for our customers, and that investor-owned companies should take the lead in creating a cross-country grid."

Mr. Roddis also stressed the urgent need for the utilities to get together on the preferred voltages for EHV, and to make their facilities as unobtrusive as possible.

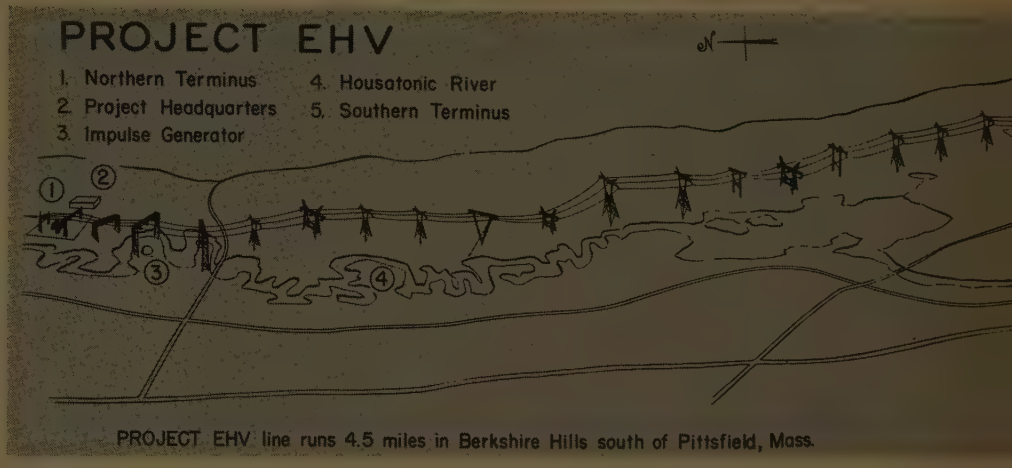
C. H. Linder, vice-president, Electric Utility Group, General Electric, told the group of the load concentrations and rights-of-way problems that are creating the pressures for higher transmission voltages. He expressed confidence that Project EHV will make the kind of contribution in transmission technology that is needed.

Relationship between cost and return on such a project is hard to measure, observed R. L. Gibson, vice-president and general manager, G-E Transformer Division. However, a company must earn growth through technological contributions which he said have cumulative effects.

The scope and significance of Project EHV was outlined by L. Wetherill, engineering manager of G-E's power transformer department. He stressed that unit cost

Housed in this bubble-type enclosure located below Tower No. 2 is a 3-million-volt impulse generator to be used to bombard the line with artificial lightning. Lightning-collector spires 40-ft high on each portal tower assist in attracting natural lightning to system.

Dr. P. A. Abetti, manager of G-E's Project EHV, stands before Tower No. 1 on the 750-kv prototype transmission system.



PROJECT EHV line runs 4.5 miles in Berkshire Hills south of Pittsfield, Mass.

goes down as voltage goes up, despite the rise in terminal-equipment cost as voltage increases.

Total cost of the project is estimated to be in excess of $7.5-million. In addition to G-E, which is coordinating the test program under Dr. P. A. Abetti, project manager, 12 other companies are contributing equipment and services to this unique cooperative enterprise. Assistance is being rendered by an Advisory Council, composed of executives and engineers from 15 U. S. and Canadian utilities, and a Consulting Engineers Committee, numbering engineers from 14 consulting engineering firms.

Companies participating in 750-kv project are listed on page 87.

Advisory Groups For Project EHV

1. Advisory Council—executives and engineers from 15 electric utilities of the United States and Canada.

J. J. Archambault—Hydroelectric Commission of Quebec

R. F. Bovier—Pennsylvania Electric Company

Dr. H. M. Ellis—International Power and Engineering Consultants, Ltd.

L. R. Gaty (chairman)—Philadelphia Electric Company

K. E. Hapgood—Tennessee Valley Authority

W. R. Johnson—Pacific Gas & Electric Company

E. L. Kanouse—City of Los Angeles

L. F. Lischer—Commonwealth Edison Company

E. R. Moore—Detroit Edison Company

W. S. Price—American Electric Power Service Corporation

L. M. Robertson—Public Service Company of Colorado

E. A. Rothfus—Ohio Edison Company

E. C. Starr—Bonneville Power Administration

J. H. Vivian—Southern California Edison Company

J. H. Waghorne—Hydroelectric Commission of Ontario

2. Consulting Engineers Committee—engineers from 14 consulting firms.

J. E. Barkle—Bechtel Corporation

P. L. Bellaschi

O. E. Charleton—Southern Services

J. Q'R. Coleman—Stone & Webster Engineering Corporation

J. H. Foote—Commonwealth Associates

J. C. Hitt—Jackson & Moreland

J. P. Ressler—Black & Veatch

R. L. Kimball—Gibbs & Hill

T. O. Millard—Pioneer Service & Engineering Company

R. E. Moran—Chas. T. Main

E. G. Norell—Sargent & Lundy

A. H. Phillips—Gilbert Associates

G. B. Scheer—Kaiser Engineers

S. B. Smith—Ebasco Services

PROBLEMS IN SAFETY GROUNDING FOR LINE WORK

Established procedures for safety grounding and bonding in power-system maintenance and operation still leave room for considerable improvement.

By J. G. CASSAN, Supervising Engineer,
Transmission Distribution and Utilization Section,
Electrical Research Department,
The Hydro-Electric Power Commission of Ontario

ACCIDENTS DO OCCUR in spite of normal safety grounding for power-system work; and in recent years serious questions have been raised about the adequacy of present grounding practice.

While there may be a diminishing need for continually emphasizing the positive virtues of safety grounding, it may be useful to review the basic hazard mechanisms involved, and the requirements of appropriate safety grounding methods.

The Basic Problem

For the purpose of this discussion, safety grounding is defined in a general way as the application of protective grounding systems for the safety of personnel working on de-energized equipment or circuits.

The basic problem is to guard against electric shock arising from unintentional energization of the isolated plant. Since the working position usually involves contact with structures connected in one way or another to earth, it seems obvious that we need to bond together the normally-energized components of the plant to be worked on, and connect them to adequate ground electrodes. Thus we hope that in any circumstances likely to arise, all the conducting parts contacted by the workman will be held at or near ground potential.

The difficulty starts when we try to specify "adequate ground electrodes." As we shall see, there are some situations in which adequate ground electrodes are unobtainable. All practical grounds have some resistance and must carry current when doing their job. The isolated plant cannot, therefore, be maintained exactly at earth potential. The departure from true ground potential may be big enough to make the difference between safety and hazard; and the limitations on the quality and quantity of grounds due to working conditions, economics, and plain physical facts may be such that we cannot just order up more of the same and hope for the necessary improvement.

We are forced to accept the possibility that the voltage of our isolated plant may rise considerably above earth potential, in spite of our safety grounds, and to adopt additional measures for controlling shock voltages at the work location.

Bonding, therefore, becomes a necessary and also, fortunately, a cheap and effective adjunct of grounding. Bonding comprises the interconnection of all exposed conducting parts with low-resistance metallic connections, so that regardless of the potential rise of the plant above earth, no dangerous potential can occur between conducting parts contacted by workmen.

It is true, of course, that some form of bonding is incidental to many systems of grounding, and the emphasis on bonding, as distinguished from grounding, may seem unnecessary. We can, however, reach wrong and dangerous conclusions if we regard bonding as always incidental to grounding. In some situations safety is primarily dependent upon bonds, and grounds become incidental; and in many situations the best safety grounding practice, in terms of safety, working convenience and economy, can be achieved only by the proper combination of the two methods.

Since all the basic hazard mechanisms with which safety grounding is concerned are encountered in overhead line work, it is convenient to choose this phase of the problem for purposes of illustration. The principles evolved can be applied to most other aspects of power-system work involving safety grounds.

Ground Overhead Lines

When an overhead line is isolated for maintenance or construction the various work locations may be subject to shock voltages from several sources. These include:

(a) Electrostatic or electromagnetic coupling with energized circuits.

(b) Accidental energization from the normal power supply or from a power cross with an energized circuit.

These voltages may appear between conductors, between conductors and structures, or between conductors or structures and the earth's surface, the latter being of interest from the viewpoint of safety of personnel working at ground level. Let us examine the safety grounding requirements for overhead workers, first on steel-tower lines, second on wood-pole lines; and then the requirements for operations carried out at ground level.

Electrostatic Coupling

Fig. 1 shows schematically the electrostatic coupling due to capacitance between two adjacent circuits, one isolated and the other energized. The greater the lengths of the parallel circuits, the greater is the capacitance between them.

Calculations for a typical 230-kv double-circuit steel-tower line show that if no grounds are applied capacitive coupling will raise the isolated circuit conductors 6 or 7 kv above ground. Fig. 2 shows the current which would flow through a person contacting conductor and tower. For sections of line less than 100 or 200 feet, a person could effectively ground the line without drawing more than a few milliamperes of current. If the conductor

Editor's note—This is the essential text of a paper presented by the author before the October 20, 1960, meeting of the National Safety Congress.

section exceeds 1500 feet, body currents increase to 10 milliamperes or more, due to the larger capacitance between circuits. For lengths in excess of two or three miles, the body currents are lethal.

Simple grounds will suffice to lower the electrostatically-induced voltage to harmless values. For the case illustrated, one 50-ohm ground for each five miles of exposure would suffice to reduce the touch voltage to less than ten volts.

Electromagnetic Coupling

Fig. 3 shows schematically the inductive coupling, or transformer action, between the two circuits. Current flowing in the energized circuit produces electromagnetic flux which links the isolated circuit conductors, and induces a voltage on them.

Using the typical 230-kv double-circuit tower mentioned earlier, we find that for normal load currents in the energized circuit the induced voltage is ¼ volt per thousand feet of parallel line for each 100 amperes of load current.

If a ground fault occurs on the energized circuit the situation is much worse. Since the fault current flows on one conductor only and returns through the earth, the coupling in this particular case is 40 times greater, producing an induced voltage of ten volts per 1000 feet of exposure per 100 amperes of fault current.

Thus, if we were stringing four miles of conductor on the dead circuit, a load current of 300 amperes in the adjacent circuit would induce about 19 volts, but a 3000-ampere ground fault would induce 7500 volts on the isolated circuit conductors. If these conductors are grounded at one location, say at one end, the entire voltage appears between the remote end and ground, and proportionate voltages appear at intermediate points.

If grounds are applied at two locations, the resulting circulating currents in the conductor-earth loop will partially neutralize the induced voltage. Neutralization is incomplete, with practical grounds, however, and in some instances is entirely inadequate. For example, if the fault lasts 15 cycles, the shock voltage must be limited to 250 volts for safety. This would require ¼-ohm grounds at each end of a 4-mile section of our hypothetical line; conditions which are practically impossible to achieve. Closer spacing of grounds may not improve things significantly since the requirement is for ground resistances small with respect to the impedance of the circuit between grounds.

In such cases, therefore, it may not be feasible to rely on grounds alone, and bonding is required. This means bonding at every work location. If a metallic connection is made between conductor and tower at each work location, no shock voltage will appear at these loca-

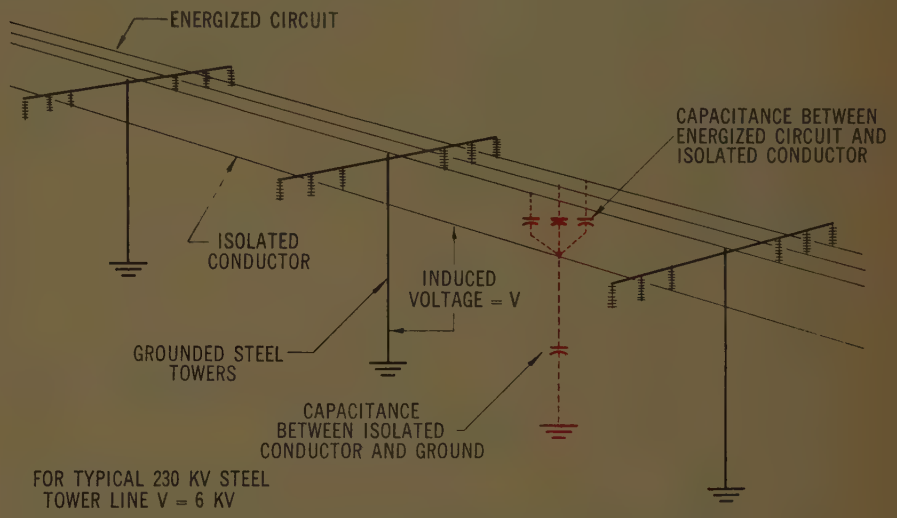


Fig. 1—Electrostatic coupling produces voltage between isolated conductor and tower.

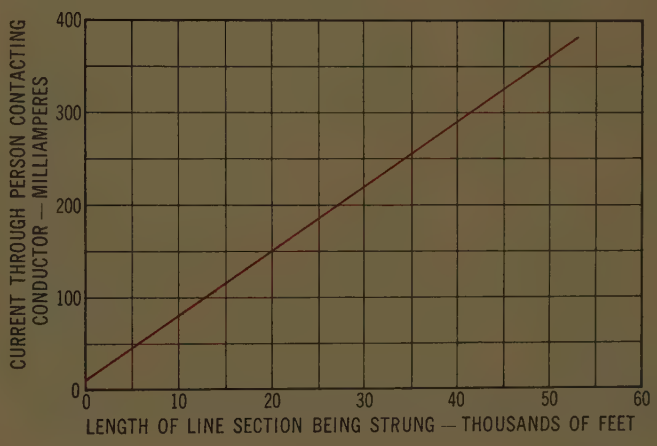


Fig. 2—Body currents caused by electrostatic voltages.

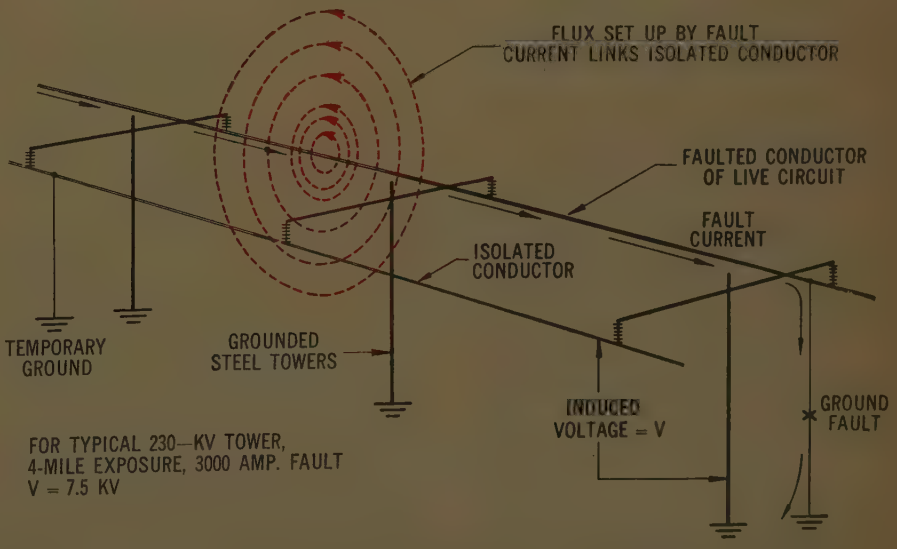


Fig. 3—Inductive coupling produces voltage between isolated conductor and tower.

tions regardless of the value of induced current. The method is illustrated in Fig. 4.

Accidental Energization

Fig. 5 shows schematically a case in which an isolated circuit conductor is energized through accidental contact with a subtransmission circuit. The isolated conductor is grounded by temporary grounds several spans apart to allow work to proceed on the portion of line between grounds.

Workmen on structures between ground points are not protected. If, for example, the two grounds provide a net resistance to ground of ten ohms—an optimistic figure—a ground fault current of a few hundreds of amperes will produce a few thousands of volts between the conductor and any of the intermediate structures between grounds.

Decreasing the spacing between grounds does not improve the situation. Again the answer lies in bonds at each work location, to provide a low-resistance connection between conductor and tower.

Wood Pole Lines

The previous discussion dealt with steel-tower lines, where bonds are easily applied by making a proper connection between conductors and tower steel.

The sources of hazard on wood-pole lines are similar to those on steel-tower lines, and the same limitations on the effectiveness of safety grounds apply. Since the resistance of a wood pole may be as low as 2000 ohms per linear foot, the pole must be regarded as an electrical conductor from the point-of-view of shock hazard. Unfortunately, it is a sufficiently poor conductor to present a difficult bonding problem.

Fig. 6 shows a solution proposed in Reference 1, making use of a metal band encircling the pole below the work location. All de-energized conductors on the pole, and any grounded conductors present, are bonded together and connected to the collar. The object here is to keep all parts of the pole and

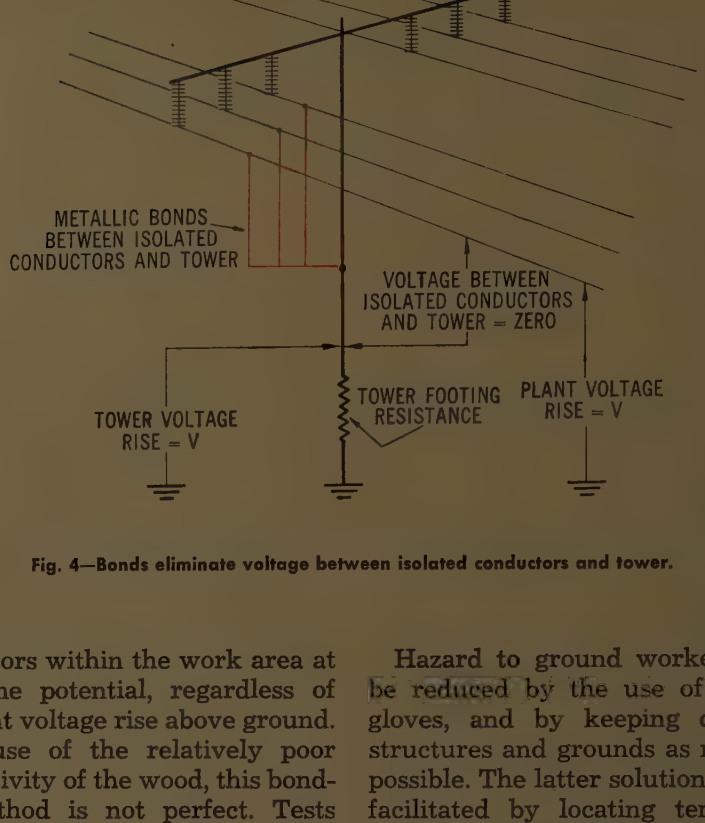


Fig. 4—Bonds eliminate voltage between isolated conductors and tower.

conductors within the work area at the same potential, regardless of the plant voltage rise above ground.

Because of the relatively poor conductivity of the wood, this bonding method is not perfect. Tests have shown, however, that on wet poles the available shock current is reduced to less than four percent of the value reached without bonds, while on poles which are only slightly moist the figure is 13 percent. These values are improved by fitting the bonding collar with conducting points on its inner surface to penetrate the outer layer of wood. Shock current reductions of this order are sufficient to completely eliminate hazard in most circumstances.

Protection of Workers at Ground Level

It was shown in the previous discussion that in some situations isolated conductors and structures may experience a voltage rise above ground in spite of the application of safety grounds. It was shown that workers on the structures can be protected by means of bonds at every work location. Ground workers may still be exposed, however, to shock voltages which appear between structures and surrounding earth, or between adjacent points on the earth's surface in cases where ground currents may flow in the work location.

Hazard to ground workers may be reduced by the use of rubber gloves, and by keeping clear of structures and grounds as much as possible. The latter solution may be facilitated by locating temporary grounds outside the work area.

Some work situations require that the workman stand in close proximity to the structure during operations involving a risk of accidental energization. One effective approach in such cases involves the use of metallic ground mats, a practical solution where the work area is limited and well-defined.

Fig. 7 shows a typical application of such mats at air-break switch locations where the operator stands on the ground and operates the switch handle. Fig. 7(a) shows a common protective arrangement in which the operator stands within a triangular area formed by three ground rods which are interconnected and bonded to the switch handle. If the switch should flash-over to ground during operation, fault current flowing to ground via the rods will raise the potential of the operating mechanism above remote earth. The configuration of the rods reduces ground current density in the operator's vicinity so that the full voltage rise does not appear between the operator's hands and feet.

Experiments made in an electrolytic tank at the Ontario Hydro

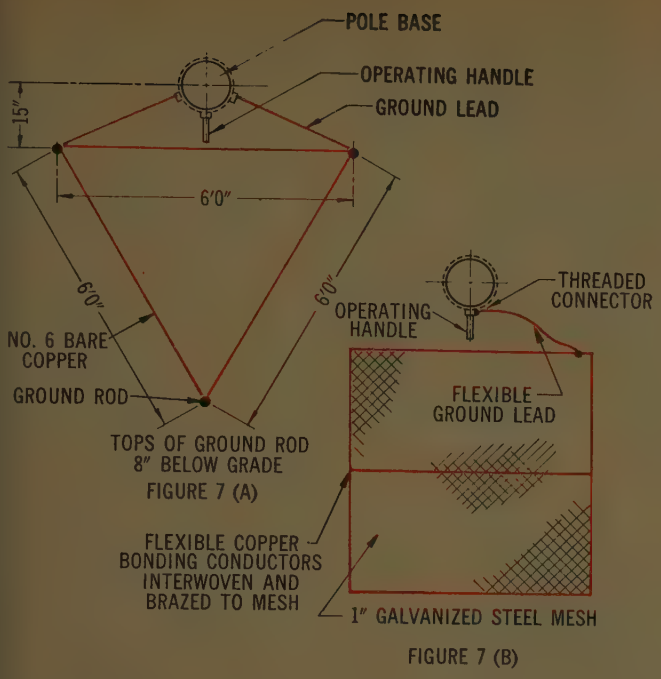


Fig. 7—Application of ground rods and portable ground mat for safe operation of pole-mounted switch.

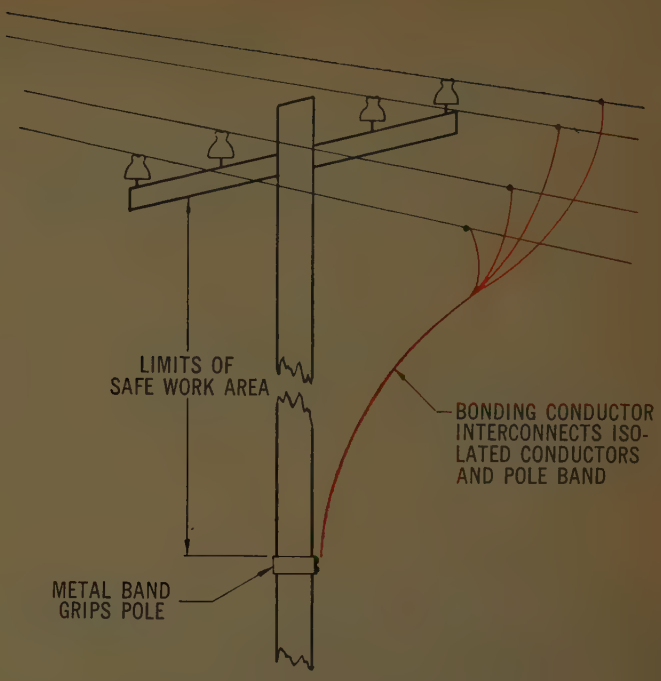


Fig. 6—Bonding principle applied to wood pole.

laboratory showed that even the most elaborate of these arrangements does not limit the hand-to-foot potential to less than 40 percent of the total voltage rise of the switch handle. With rod resistances of practical values this represents a serious hazard on most grounded-neutral systems.

Since the objective in this case is simply to keep the operator's hands and feet at the same potential, again a form of bonding is the answer. In this case it was achieved by the use of a portable ground mat, made of galvanized steel mesh, with a flexible bonding conductor permanently connected to it.

The arrangement is illustrated in Fig. 7(b). In use, the operator unrolls the mat in the appropriate position, stands on it and connects the flexible bonding conductor to the metal operating rod. No matter how high the voltage on the switch handle may rise, the handle and the mat, and hence the hands and feet of the operator, remain at exactly the same potential. In this case the role of the switch-handle ground electrode is only to ensure that the ground-fault current is sufficient to ensure prompt de-energization of the circuit.

This principle can be applied in other situations where the work area is limited and well-defined, an example being the application of permanent conducting mats in the vicinity of station structures. If suitable materials and techniques are developed, it may provide an answer to some difficult problems, still unsolved, in relation to the safe operation of cranes, diggers, stringing equipment, etc., in the vicinity of energized equipment.

Summary and Conclusion

Safety grounds constitute the first step in providing safe working conditions on isolated equipment or structures, and may be the only requirement if the hazards are limited to those arising from electrostatic induction, or if the maximum ground currents in the related parts of the system are small.

In many practical work situations, grounds alone are inadequate, and conducting bonds must be incorporated into the protective scheme.

In conclusion, three points not specifically dealt with in the earlier discussion are worthy of note. These are:

(1) In all safety grounding and bonding systems special atten-

(Continued on page 75)

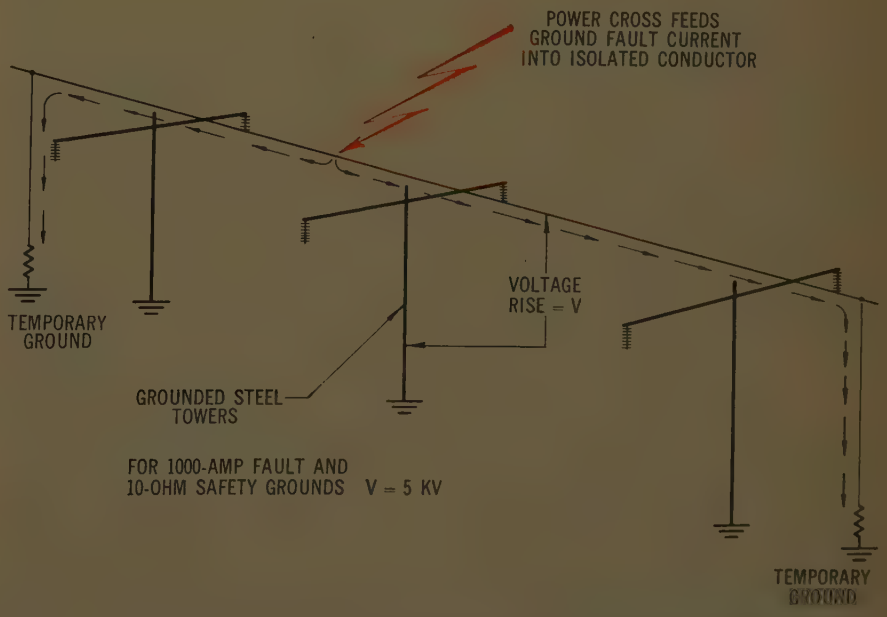


Fig. 5—Power cross produces voltage between isolated conductor and tower.

STAINLESS STEEL UPS CONDENSER TUBE LIFE 300%

By ERNEST R. LONG, Test Engineer, Monongahela Power Company

Longer life, better performance, less corrosion and easier installation and cleaning are advantages of stainless steel condenser tubes proved by utility's experience with highly corrosive river water.

Stainless steel tubes were easier to install than copper tubes, both in "sticking" and "rolling." They are expected to last 30 years compared to seven years for the formerly-used copper alloy tubes.

EXPERIENCES with the use of 22 Bwg Type 404 stainless steel condenser tubes by Monongahela Power Company at its Rivesville (West Virginia) Station, has indicated that they will last up to 30 years compared to seven years for the formerly-used 16 Bwg 88-10-2 copper alloy tubes. The stainless steel tubes cost 19.55-percent more than the copper tubes at the time of the installation.

The stainless tubes were easier to install than copper tubes, both in "sticking" and "rolling." Less than ten leaks were found after the tubes were "rolled" and tested and there was no difficulty in correcting them.

Due to coal mine drainage the river water is highly corrosive—normally acid. Its pH has been less than three during dry seasons, and gets up to six during rainy seasons.

The copper alloy tubes in Unit 6 lasted 6⅔ calendar years while being in service about 90-percent of the time. Machines that are in service about 70-percent of the time will manage to get 8½ to 9 years life out of the same kind of tube.

Cleanliness Is Low

The average practical cleanliness of a set of copper alloy tubes is less than 60-percent. It would be possible by mechanical or chemical means to restore cleanliness to a higher level, but they will not retain such cleanliness for a sufficient time to recover the cost of cleaning. The bare tube surface would be exposed to direct attack from the acid water and tube life would be appreciably shortened.

A new set of tubes will generally give excellent performance for a few days, but in a short time they become fouled and their performance will fall below the 60-percent cleanliness factor level before the usual cleaning methods will show any recovery. Unless sufficiently oversize metal scraper type slugs are used that will cut the scale down to bare tube metal, a cleaning will not approach restoring performance to the level experienced with brand new tubes during their first days in service.

Performance Experience

Fig. 1 is a graph showing the performance experience with 88-10-2

copper tubes. The average water velocity through the initial set of tubes was about 7.0 fps with two circulating water pumps in service. The dashed line curve represents the performance expected with 85-percent clean tubes. The only time we experienced this performance level was with a new set of tubes. Our average performance with any condenser having copper alloy tubes is within the limits of 50-percent and 60-percent cleanliness factor.

Rivesville Unit 6 is a tandem-compound double-flow, impulse reaction type condensing turbine. Steam conditions at the throttle are 1250 lb and 950 F. Steam exhausts from the turbine into a two-pass radial flow condenser.

The unit went in service September 1, 1951, with 16 Bwg 88-10-2 copper alloy tubes in its condenser. By May 2, 1958, the average wall thickness of these tubes was slightly over .020 in. As they become thinner than this they might at any time become subject to mass failure. While the unit was down at this time for inspection and repairs, the condenser was retubed with 22 Bwg Type 304 stainless steel tubes. The unit was returned to service July 18, 1958.

Our Company has over the years tested a number of copper alloys and a few steel tubes for the purpose of establishing their relative life expectancies at the Rivesville Station. Type 304 was found to be quite durable but was considered unacceptable as a full condenser installation because of its cost and reputed poor heat transfer capability. It had, however, been accepted for use to fill the small section under air baffles where copper alloys are subject to possible ammonia attack.

Surface Conditions

Comparison of the surface conditions, of Type 304 stainless tubes after they had been in service seven years to the surface conditions of copper alloy tubes that had been in service just a little more than one year, revealed a considerable difference in the effect of this river water on the two alloys. At Rivesville copper alloys tend to acquire on their water side a rough surface coated with a thin tenacious layer of corrosion products. Any accumulation of mud and slime on top of this is apparently easy to remove with nylon brushes, but the tight skin of corrosion products requires a harsher cleaning method.

The stainless tube did not bear any evidence of a tight corrosion film and seemed possible of being consistently cleaned by shooting nylon brushes once through each tube. It was also noted that the steam side of the steel tube was clean and bright while the corresponding sides of the copper tubes were coated with a dense brownish-black film of iron oxide. The general state of the copper alloy surfaces suggested the probable reason for the inability to recover performance to what would seem to be a reasonable level. The apparent absence of any evidence of corrosion attack on the steel tubes suggested the possibility of using thin walled steel tubes to offset their inherently poor heat transfer ability compared to copper alloys, and permit taking advantage of their better susceptibility to cleaning.

Performance

By current HEI standards, 85-percent clean 22 Bwg stainless tubes should almost equal the performance of 60-percent clean 16 Bwg 88-10-2 copper alloy tubes. Knowing that the cleanliness of copper alloys could not be restored too much better than 60 to 65-percent, there seemed a good chance that on a heat transfer basis stainless tubes would not be too far behind if they could average 85-percent or better cleanliness factor.

We believe that 22 Bwg stainless will last up to 30 years compared to seven years for copper in Unit 6 condenser. If this be so, and we could consistently recover to a reasonable performance level when cleaning became necessary, stainless tubes seemed to be the logical choice.

It was assumed that with the same pumping facilities the water velocity in the 22 Bwg stainless steel tubes would be 6.5 fps. With 7.0 fps water velocity in the 16 Bwg copper tubes their performance when 60-percent clean will be slightly better than 85-percent clean stainless steel tubes having only 6.5 fps water velocity. It is apparent that if the average cleanliness of stainless steel tubes could be maintained to approximate the 85-percent cleanliness performance curve, they would not be too much worse performance-wise than copper tubes that are only 60-percent clean.

Performance Curves

Fig. 2 gives a picture of the performance experienced to date with stainless steel tubes. The upper solid line curve shows the turbine back pressures in inches of mercury absolute that we should expect with reference steam flow and water velocity, with 85-percent clean 22 Bwg Type 304 stainless steel tubes, and water temperatures varying from 32 to 82 F. The dashed line curve, which is fairly close to it, shows the turbine back pressures that we should expect with 60-percent clean 16 Bwg 88-10-2 copper tubes at the same reference steam flow, but with 7.0 fps water velocity in the tubes.

The 124-percent curve represents the peak cleanliness performance that we have actually attained with these tubes to date. This degree of cleanliness was obtained by shooting with nylon brushes, after noting that performance seemed to be improving due to self-cleaning from sand and abrasive sediment in suspension in the river water at the time. Cleaning at that time was not actually needed, but

Less than ten leaks were found after the stainless steel tubes were "rolled" and tested. There was no difficulty in correcting them.

it was believed that while the self-cleaning was going on a nylon brushing might tend to help it along, and perhaps hasten the approach to a perfectly clean condition on the water-side.

The black dots correspond to the actual back pressures obtained by tests made since the stainless tubes were installed. They too are plotted for the reference water velocity of 6.5 fps. An average curve of these actual performances will lay somewhere between the 87-percent and the 124-percent clean stainless steel performance curves. By utilizing the self-cleaning characteristic of stainless tubes it might be possible to move the average actual performance closer to the maximum cleanliness performance condition.

Heat Rate Is Improved

Our copper alloys average something less than 60-percent cleanliness factor, and consequently their average actual performance curve is above that of 85-percent clean stainless at reference conditions. Therefore, the overall turbine heat rate has been appreciably improved by the change to stainless steel condenser tubes. This could not be anticipated since there was no previous experience to indicate that stainless steel might be better than we expected.

Fig. 3 is a graph of cleanliness factors vs valendar time, representing the history of Unit 6 condenser cleanliness from the time of the first performance test in July, 1958, to the last performance test made in August, 1959. Since a cleaning is expected to restore the cleanliness factor to some higher level, the open spaces were left between the adjacent segments of broken lines to indicate a cleaning was done between two tests. The natural trend of the cleanliness factor due to river conditions is reflected in the connected segments as time progresses. A rising cleanliness factor indicates natural self-cleaning due to the presence of abrasive matter in suspension in the river water. Self-cleaning is most pronounced and noticeable when rains have colored the river with sand and silt.

Suspended Solids

The frequency of required cleaning seems to depend upon the amount (or lack) of suspended solids in the cooling water. Note that from early in January to the last of March 1959 no cleanings were attempted. The cleanliness condition during this period remained at such a level that sufficient gain in performance would probably not be realized to recover the cost of cleaning. The reason for this particular period of sustained fair cleanliness was the frequent rains that occurred during the time which kept the river fairly well loaded with matter which tends to scour the water-side surface of the tubes. The pattern of the graph for the months of January, February, March tells the story of the ups and downs of the cleanliness state of the stainless tubes as it followed the changing river conditions. Toward the end of March it nosedived to a level where the chances of recovery were sufficient to justify the cost of a cleaning by shooting nylon brushes through the tubes.

The more rapid and sustained declines in cleanliness are found during periods of dry weather. When there is no rainfall to help the situation, cleanliness may drop steadily to a point where a cleaning is in order. The proper time for a cleaning depends upon the rate of declining cleanliness, and the time necessary to accumulate a loss equal to the cost of cleaning. If a good cleaning job has been done performance will be restored to a reasonably good level and, assuming continued dry weather, will again gradually decline to some level when another cleaning is indicated. Except for the prolonged wet weather periods, we will probably clean the stainless tubes just as frequently as we will the copper tubes. However, there is a difference—we consistently recover sufficient performance to offset the cost of cleaning stainless tubes but this is not always true in the case of copper alloy tubes.

Velocity Effect

Fig. 4 illustrates the effect on performance of the actual average water velocity of 7.5 fps through the stainless tubes relative to the performance that results at the expected water velocity of 6.5 fps. The dashed line curves represent performance at the standard condenser load of 566,000 lb per h steam flow with 6.5 fps wate velocity in the tubes when 85-per cent clean and 124-percent clea When the water velocity increase to 7.5 fps the performance shifts within the boundaries of the soli line curves at 85-percent clean an 124-percent clean. With further in creases in velocity we can expe further shifting of average perform ance toward still lower turbine ex haust pressures.

Stainless Versus Copper Alloy

Fig. 5 is a graph illustrating th better performance of the stainles steel tubes compared to the coppe alloy tubes. With average wate velocities of 7.5 fps the actual per formances of the stainless tubes fa within the boundaries of the 8 percent and 124-percent solid lin curves. The actual performances 88-10-2 copper tubes did not aver age as good as the dashed line curv for 60-percent clean copper at 7. fps. The cleanliness of the coppe tubes was seldom good enough produce turbine exhaust pressure equivalent to those of 85-percen clean stainless at 7.5 fps, and abou the only time they produced bac pressures corresponding to th dashed curve for 85-percent clea copper tubes at 7.0 fps velocity wa within a few days after they firs went in service. At average loa with these stainless steel tubes th turbine exhaust pressures are fro ½ to ¾ in. lower than with th original copper alloy tubes.

As previously stated, further in creases in water velocity throug the tubes would tend to further im prove the performance characte istic. It appears that we average ½ fps more velocity with the stainles tubes than we did with the coppe alloy tubes, and without makin any change in the available pump ing facilities. This is apparently du to less system resistance with th stainless tubes than with the cop per tubes.

Natural Scouring

The apparent susceptibility stainless steel tubes to natur scouring and self-cleaning whe water conditions are appropria presents the possibility of introdu ing some facility that will induc this action, either continuously

intermittently, at any time and without the loss of any load on the machine. Assuming such a provision to be practical, a unit would, in respect to its condenser performance, be able to operate very close to maximum efficiency at all times.

In our experience to this time with stainless steel condenser tubes, we find that they are capable of much better heat transfer than we had expected. It seems apparent that thin walled stainless tubes will produce turbine exhaust pressures equivalent to or better than thick walled copper alloys at any given load and given water velocities. Where fouling is a factor and cleanliness is more easily maintained in stainless tubes their better heat transfer becomes an important consideration.

Self Cleaning

We find the stainless tubes do tend to self-clean, and probably higher water velocities contribute toward this. A certain amount of this higher velocity is apparently due to less resistance inherent in the tubes themselves. In new units the advantages of greater velocity can be incorporated in the design of the condenser. The fact that they will self-clean with only sand and silt in suspension in the cooling water indicates they may prove adaptable to some means of inducing self-cleaning as desired, without taking any part of the condenser out of service.

Stainless Performance Better

In all respects the differences in performance of stainless steel tubes from that of copper tubes are definitely in favor of the stainless. Some of these advantages were entirely unexpected, it is true, but they exist nevertheless. This does not necessarily mean that stainless steel tubes are a universal answer. They may still be justifiable only under certain economic conditions. However, another look at Fig. 5 will reveal that, even though there be no corrosion and cleanliness problems and lighter gauge copper alloys could be used, it is possible steel tubes having still thinner walls can be made to approach, or possibly equal, that of copper alloy tubes by increasing the water velocity.

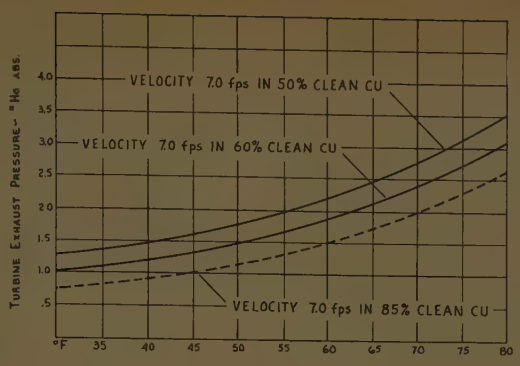


FIG. 1

Graph showing performance experienced with 88-10-2 copper tubes. Actual average performance falls within the limits of the 50-percent clean and the 60-percent clean curves. 85-percent cleanliness is seldom realized under normal conditions because of corrosion deposits on tube surfaces.

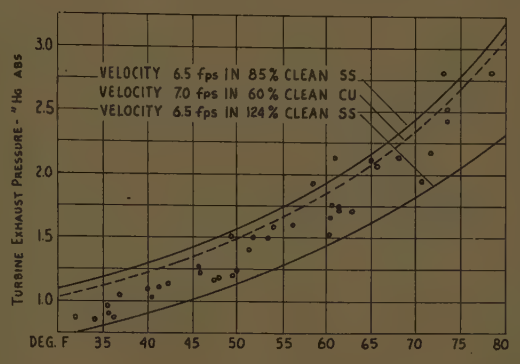


FIG. 2

Graph showing performance experienced with Type 304 stainless steel tubes. Actual performance at 6.5 fps water velocity is shown by the black dots, most of which fall within the boundaries of the 85-percent clean and the 124-percent clean curves.

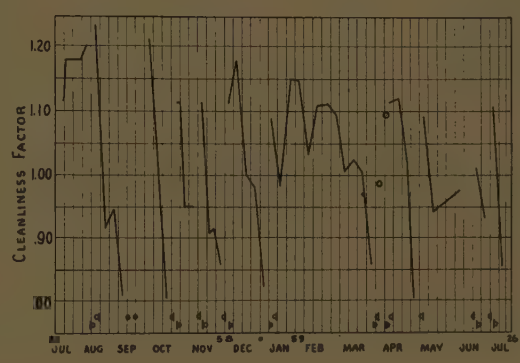


FIG. 3

History of condenser cleanliness from actual tests from July 1958 to August 1959. Trend of condenser cleanliness as stainless steel tubes became fouled and/or self-cleaned is shown by slope of line connecting test points. Unconnected test points (breaks in continuity) indicate a once through shooting with nylon brushes.

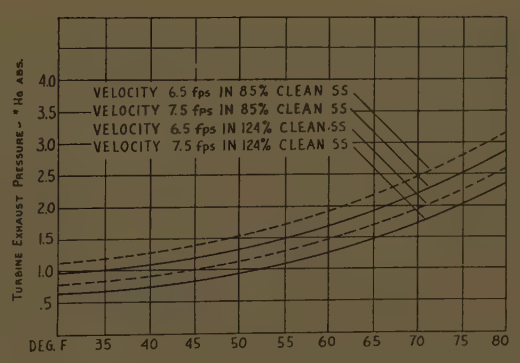


FIG. 4

Effect on performance of actual average water velocity of 7.5 fps through the stainless steel tubes relative to the performance that results at the expected water velocity of 6.5 fps. Overall gain in performance due to actual average water velocity of 7.5 fps instead of the expected 6.5 fps is indicated by positions of solid relative to dashed line curves.

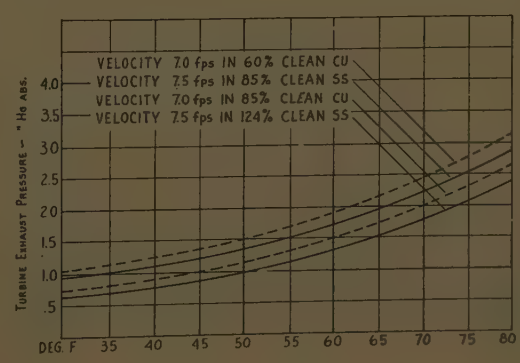
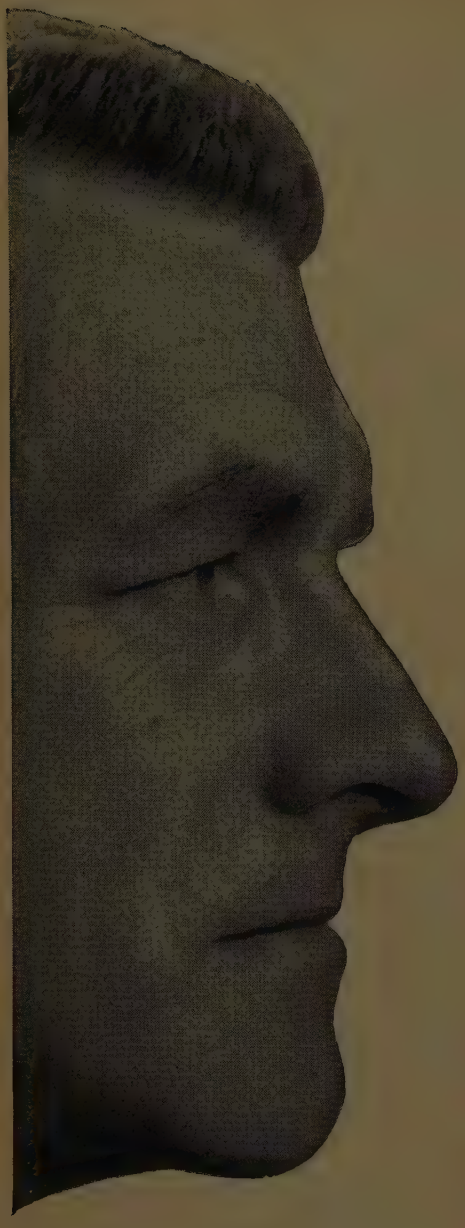


FIG. 5

Actual stainless steel performance compared to copper alloy tubes. It generally falls within the boundaries of the 85-percent clean and the 124-percent clean solid line curves at water velocities averaging 7.5 fps.



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Here's a scoop about the new

MOLONEY

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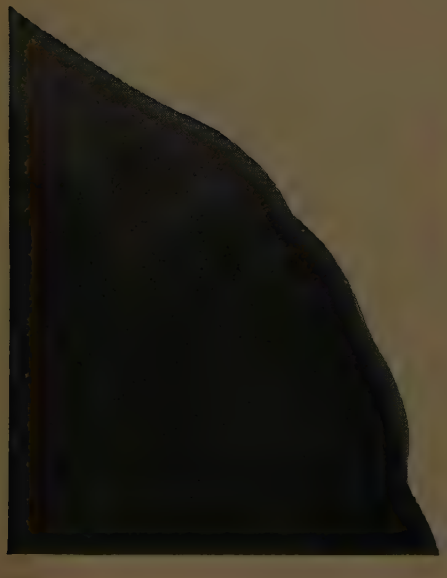

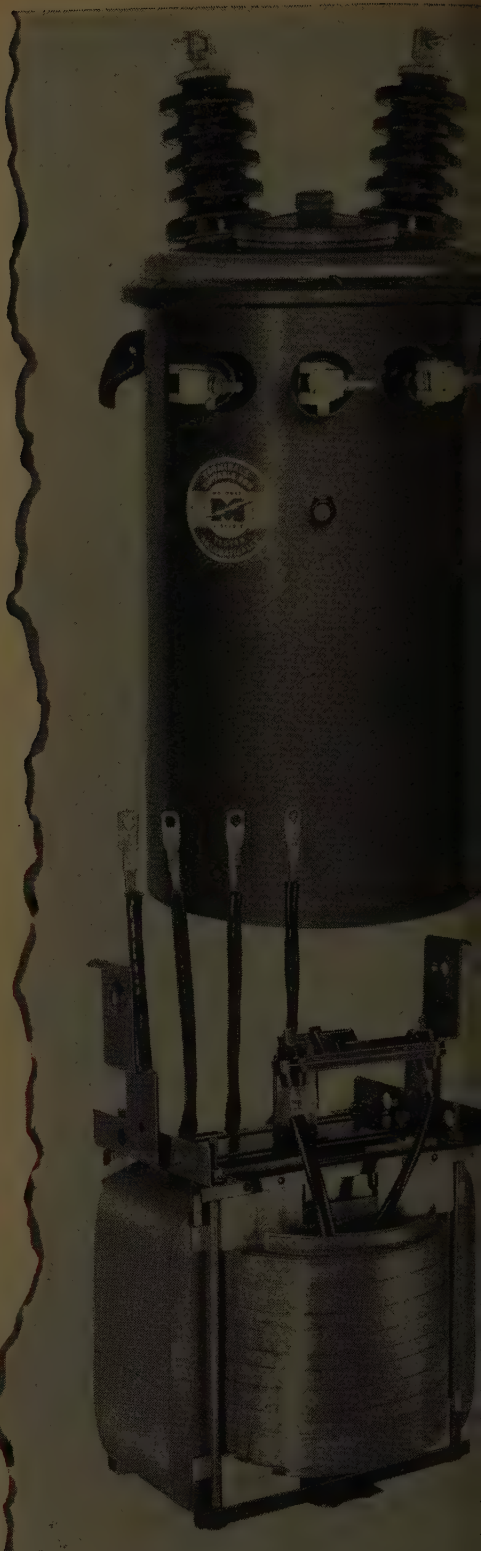

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below—A 600-hp, 1200-rpm Elliott synchronous motor with direct-connected exciter, powers a Carrier compressor at International Business Machines Corporation, Kingston, New York—another example of Elliott motors furnishing electric power for commercial buildings and industrial plants.

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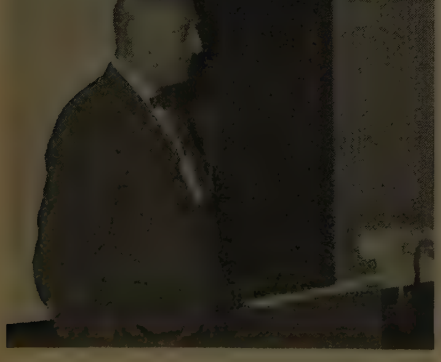
Sangamo Power-Capacitor Workshop Seminar Attracts Utility Engineers From All Parts Of U. S.

Transmission and distribution engineers engaged in power-capacitor applications throughout the country gathered at Springfield, Illinois, on Nov. 15-17 for the Sangamo Electric Company's Third Annual Power-Capacitor Workshop Seminar. Featured on the program were outstanding leaders in the electric-utility industry who presented papers on the design and application of power capacitors, controls, and measurement equipment. Panel and group discussions followed.

Seminar delegates were welcomed by Glenn DeKraker, manager of marketing for Sangamo. He then called on Dr. E. T. B. Gross, professor of electric power systems, Illinois Institute of Technology, to review power-system conditions which govern capacitor applications. Dr. Gross also served as group-discussion moderator throughout the sessions.

Central Power & Light's program of system-wide installation of graphic kw and kvar demand meters at major substations was described by C. A. Mast, distribution maintenance and operations engineer. Eventually plug-in facilities will be provided for metering of all 12-kv feeders on the system. These measurements are made annually and also provide a check of load growth. (Mr. Mast's paper will be published in an early issue of EL&P.)

R. M. Havourd of Public Service Electric and Gas Company presented an interesting discussion on "The Application of Power Capacitor Control."



Switching of pole-mounted capacitor banks on the Public Service Gas & Electric system was discussed by R. M. Havourd, engineer with that company. He pointed out that addition of fixed reactive capacity in the form of high-voltage pipe-type cables forced the company to equip many existing capacitor banks with controls and switches, which were originally installed unswitched. Since 1953, no fixed banks have been installed.

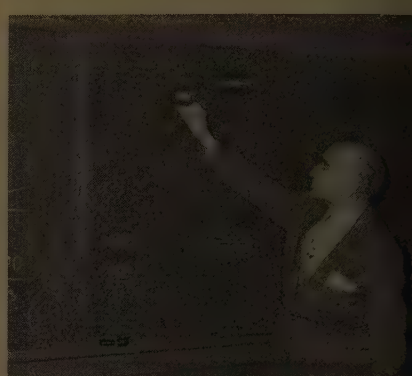
In the choice of sensing means to employ for control of switching, Mr. Havourd said it depends on what one wishes to accomplish; on the location of the capacitors; and whether or not the distribution circuits are equipped with induction voltage regulators. Sensing methods discussed included voltage, current, vars, time, temperature, and combinations of these.

A system-wide approach to capacitor applications on the Illinois Power Company system has proved to be very effective, T. W. Schroeder, manager of power production, reported in his paper. This has involved the use of a computer load-flow study in apportioning capacitors among the various parts of the system. Relatively small blocks (in terms of the total system) may be tried, permitting analysis of voltage, interchange vars and losses.

Mr. Schroeder further reported that the large increase in vars supplied by generating stations in 1960 has prompted a computer study to determine how best to supply these vars, which were drawn largely from the interconnection points.

Experience on the Bonneville Power Administration system has demonstrated that the power capacitor is the economical means of greater utilization and increased efficiency of the transmission investment, declared E. C. Starr, BPA's chief engineer. In his paper, he compared advantages of series and shunt capacitor applications, their effects on system efficiency, transmission transfer capacity, and system planning. (Mr. Starr's paper will be published in an early iss of EL&P.)

A high-voltage series capaci application has proven to be a ve satisfactory method of controlli load division between a "super-co ductor" transmission line operat in parallel with other transmissi



Dr. E. T. B. Gross of the Illinois Institute Technology, who was moderator of the se nar, carries group discussion to the blackboa

lines only one-third the wire si according to H. L. Deloney, assista chief engineer, Louisiana Power Light Co. He cited one applicati on this system in which effecti loading was doubled on a $3-milli transmission line by expenditure only $500,000 for a series capaciti Additional transfer capacity gain cost about $10 per kw, whereas a erage cost of transmission throug out the company's system is $ per kw.

C. E. Nelson, superintendent, E gineering Division, Transmission Distribution Dept., Philadelph Electric Co., described in detail t standards his company has dev oped and the procedures involved installing 240-v and 2400-v capaci units directly in the ground with grating cover. This has been fou to be a practical and economi means of providing needed kilova in underground and congested ov head areas. (Mr. Nelson's paper w be published in an early issue EL&P.)

Today's need for low-cost au matic recording of system measu ments in a format suitable for en into the utility's data-processi system was discussed in detail I. H. Peak, manager, Data Handli Systems, Sangamo Electric. He s

this need can best be satisfied through the installation of the simplest substation data logger, leaving such functions as point identification; square root extraction; and application of multiplying factor to the central data processing system. Such equipment will soon be available, he said, at an average cost per measurement point of $100 without transducer and $200 including thermal demand transmitter.

Possibilities of multi-sequence switching of capacitor banks were discussed by Dan McAuliff of Sangamo. Installations of this type, as well as biased voltage standard instruments, comprise some of the recent developments in capacitor control, he said.

J. F. Kuzela, Sangamo's engineering manager of power capacitors, outlined advances in the art of designing and producing power capacitors, with particular emphasis on

W. J. Thacker of Sangamo Electric Company speaks at a dinner meeting held for seminar participants.

improvements in materials and techniques.

A discussion of the trend toward smaller, lighter weight, better engineered capacitor equipment was presented by R. W. Tracey, Sangamo project engineer on development and application of power capacitor equipments.

Basic considerations involved in the utilization of vacuum interruption equipment for power-capacitor applications were analyzed by J. W. Rittenhouse, technical director of the Hi-Voltage Equipment Co., a division of Joslyn Mfg. & Supply Co. He expressed the opinion that in light of continuing developments, vacuum switches will assume more and more of the responsibility for switching all forms of capacitor banks on utility systems.

George L. Landgren of Commonwealth Edison Company participates in seminar group discussion.

Wendell C. Fowler, assistant to vice-president in charge of power equipment, Sangamo Electric, presented an analysis of the most effective approach to the application of switched capacitors where regulators exercise control of voltages ahead of the capacitor locations. He said no one answer appears to satisfy the innumerable conditions that may be encountered.

Experience gained by the City of Austin, Texas, in applying capacitors to its secondary network system was related by H. L. Peterson of the Electric Distribution Dept. This past summer a number of banks of 1-kvar secovar units were installed in obsolete primary meter cabinets, above ground in alleys at the customers' connection to the secondary mains. Due to variations in enclosure sizes, the various banks consisted of 36 units, 42 units, and 63 units. Installed cost was $18 per kvar.

Mr. Peterson cautioned that not all correction of power factor on network systems can be done in this manner. A large percentage must be done by installations of capacitors in the transformer vaults.

Digital Computer's Importance Increases With Equipment $-Billions At Stake

The growing importance of the digital computer to utility economics was stressed heavily at the AIEE Second Power Industry Computer Application Conference in St. Louis, Mo., November 9-11.

That the computer is coming of age was borne out by E. L. Harder, Westinghouse Electric Corp., program chairman, who reminded the group that in the next ten years, $20-30 billion of equipment investment are at stake in planning through the use of the computer.

Several technical papers brought to light new facts and amplified known facts. Excerpts from some of them follow.

System Analysis

A new short-circuit program for relay studies was presented by G. E. Taylor, General Electric Co. Co-authors were G. K. Carter, also of G. E., and E. H. MacDonald, Philadelphia Electric.

The program allows the computer to automate fault computation. Its advantages fall into two major categories: (1) Equivalents used to represent the power system components represent the system more accurately, taking into consideration such things as the complex impedance of transmission lines, off-nominal ratio and phase-shifting transformers, system voltages, and load currents. Relay settings can be selected which are more in line with actual fault currents. (2) The program handles: (a) try-back of a line with a fault at the near terminal, (b) try-back of a line with a fault at the remote terminal, and (c) faults 85 or 90 percent out on a network line.

During the discussion it was revealed that Philadelphia Electric is writing 40 sub-routines for relays.

The first two in a series of digital computer programs for distribution system analysis and design were presented and discussed by R. C. Ender, G. G. Auer, both of General Electric, and R. A. Wylie, Niagara Mohawk Power. The first calculates the positive and zero sequence impedances of overhead primary cir-

PICA conference leaders and speakers included (from left) P. P. Gubany, Bussman Mfg. Co.; P. M. Honnell, Washington University; A. P. Hayward, Duquesne Light; G. S. Whitlow, Union Electric; E. L. Harder, Westinghouse, Electric Corp.; L. B. LeVesconte, Sargent & Lundy Engineer M. W. Humphrey Davies, Queen Mary College, University of Londo and General Chairman F. J. Maginniss, General Electric Co.

cuits using conductor size, conductor material, and line geometry data. The second calculates maximum and minimum values of fault currents at specified points on a radial primary circuit using line impedance data from the first program along with voltage, source impedance, and fault impedance data. A third program is planned which will use the fault current output of the second program together with relay, recloser and fuse characteristics to determine overcurrent protection of the primary circuit.

In the development of this pair of programs, effort has been made to permit accurate representation of any of a large variety of radial distribution systems.

A program for the calculation of three-phase and line-to-ground fault currents by the LGP-30 digital computer was described by W. J. Smolinski, U. of New Brunswick. The calculation method avoids matrix inversions and utilizes a reduction formula due to Kron for eliminating one variable in a network at a time in generating a driving-point and transfer impedance matrix of the system being studied.

The fault currents obtained are equivalent to d-c network analyzer results.

Digital programs for calculation of transmission line impedances were analyzed and described by N. Savage, Detroit Edison. They were written for the IBM 650 equipped with punched card input, on-line printer, and alphabetic device. A preliminary program was necessary for the computation of the table of tower constants.

In the single tower impedance program, one input card is required for each tower, containing the tower code number, the code numbers of the conductors and ground wires, and the earth resistivity to be used in the zero sequence computations. Output is printed on-line as it is calculated.

The total line impedance program computes, for an entire circuit consisting of any number of towers, the following quantities: (1) Positive and zero sequence resistance, reactance, and impedance per phase, in per unit on bases of 100 mva and 120 kv. Impedance angle is computed in degrees. (2) Positive sequence charging kva, total three-phase at 120 kv. (3) Mutual zero sequence items as described in (1) for the specified circuit and any other circuits which share one or more towers with it. (4) Total length of the line in miles.

System Operation and Optimizing

A digital transient stability program including the effects of regulator, exciter, and governor response was presented by Mrs. M. S. Dyrkacz. Co-authors were C. C. Young, and F. J. Maginniss, all of General Electric Co. Changes which have been made in G. E.'s 1958 transient stability program included the following: (1) It is no longer necessary to assume $x_q = x'_d$. (2) Condensers can be represented by constant magnitude voltage behind a reactance and by zero power output. (3) Provision for 96 generators. (4) System loads at any bus may be represented as: (a) fixed power loads at constant power factor, (b) fixed current loads at constant power factor, (c) fixed impedance loads, or (d) any combination of these. Calculating procedure was also changed for the regulator an exciter and speed governor actio

Additions to output included cu rent magnitude being able to b read in any 25 selected lines, excep transformers, apparent impedanc power flow in selected lines, com ponents of voltage at each bus o the system. For those generato where voltage regulator respons is represented, the magnitudes the field flux linkages and the fiel voltage are listed. For those ge erators where governor response represented, input torque is liste Also added are various items input data for easy recognition system conditions.

To get a realistic yet simple pi ture of the phenomenon, the a thors reasoned that the division loads among the machines is roug ly proportional to their capacitie speed regulations, or inertias, i differently.

L. J. Rindt, R. W. Long and C. W King, Westinghouse Electric Cor re-examined the solution of the loa flow problem through the use mesh analysis, and found encou aging aspects. Most appealing is th rapid convergence of the iterati procedure for the different syste tried. For example, a system of busses and 89 lines converged to solution with a maximum P or residual of 0.1 mw in 14 iteration This solution was obtained witho prior estimates concerning the ge erator reactive power, load volta magnitudes or angles. Nodal equ tions and close initial estimates r quired 73 iterations.

Though accelerating factors we not used in the examples studi in the paper, it was noted that t load busses converged almost i mediately. To take advantage

this peculiarity, a block iteration procedure was used where the generator currents were adjusted for each iteration while the load currents were corrected only for every fourth iteration. This procedure had considerable bearing on the average time for obtaining the solution without increasing the total number of iterations.

L. O. Barthold, General Electric Co., described digital techniques which have been used to compute relative mean noise levels of high voltage lines. Co-author of the paper was A. K. Aboushi, also of G. E.

The radio interference calculation described by the authors pertains to distributed, conductor-generated corona, although it can be adapted to discrete noise sources as well. The problem has been treated in three steps as follows: (1) The solution for the noise generation density on the surface of each conductor. (2) The solution for the total noise voltage on each conductor due to distributed noise generation on that and other conductors. (3) The solution for the field intensity at the ground surface due to noise voltage on all conductors.

Electric power flow calculations using a matrix method were described by H. E. Brown and C. E. Person of Commonwealth Edison. The method is based on the Z-matrix. The program has been written to determine power flows for a multigenerator system using a modified d-c board approach. The program is assembled for an IBM 704.

In the initial case of a set of power flow studies the program calculates the Z-matrix from the original input data. Line identification, impedance, ratings, and an external identification code are included in the input for each line. Generators and loads may be introduced with either reactance data or with their generation or load specified. For subsequent cases the matrix is not recalculated but only modified for each change. For line changes the program uses the change in impedance as an additional line for matrix modification and then updates the line list by adding the change in impedance to the impedance of the original line.

System Planning

Computed selection of generating units to be operated was covered in two companion papers. The first, "Economic Evaluation on Small Computer" by W. H. Osterle, J. W. Geiser and H. T. McCarthy, all of West Penn Power. Variables involved in the problem of selecting generator units to be operated included: (1) Hourly production costs as a function of particular combination of generating units; (2) Start-up and banking costs of the various generator-boiler combinations; (3) Possible generating combinations as a function of system load level. The program was set up to determine these costs.

The program's most serious limitation is that in essence it is used to test a series of alternatives, preselected by the operator, and to determine the least expensive of these. The desire to eliminate this limitation provided the motivation for using the Dynamic Programming techniques described in the companion paper.

This paper, "By Dynamic Programming on a Large Computer," by Mr. Osterle, K. M. Dale, C. A. DeSalvo (Westinghouse), and J. Geiser, West Penn Power, illustrates how Dynamic Programming can be applied to the generation scheduling problem. The problem is to select the best combination of units to operate in each hour of the day so that the cost of supplying the system load for the day is a minimum. The procedure considers start-up and production costs for each hour of the 24-hour day, but as it considers a "new hour," it goes back to generator combinations in the preceding hours to see if the most economic path had been followed.

R. B. Squires, Westinghouse Electric Corp., presented a new method of economic dispatch of generation directly from power system voltages and admittances. The method does not use a loss formula or the somewhat variable B constants. No restrictions are placed upon the voltage magnitudes or angles in the network, except the use of constant real voltage at generators.

C. A. MacArthur of Pennsylvania Power & Light described a method which was used to extend load flow studies by a program which automatically searches for overloaded circuits upon the loss of one or more major transmission links and readjusts the interchange amongst areas until the maximum possible amount is being transmitted prior to the loss. Limits were known from previous studies to be established mainly by thermal ratings.

A program to determine fuel and investment costs for future generation systems was discussed by L. W. Coombe and W. J. Pfeifer, Jr., both of Detroit Edison. The program simulated the operation of an expanding system of generation to determine fuel and investment costs for various schedules of generation additions.

Power Plant Automation

In presenting a roundup of power plant automation as discussed at the National Power Conference, D. M. Sauter, Westinghouse Electric Corp., stressed that before the application of any equipment, the user must always define the scope of the project. Four preliminary steps are (1) Examine plant problem areas, (2) Determine extent of protection and control, (3) Evaluate currently available equipment, and (4) Justify the system.

The approach of Westinghouse to automatic computer control and supervision of a generating station was described by R. B. Squires and J. W. Skooglund, both of that company. They emphasized analysis and study of the control problem, and showed how the PRODAC control computer ties into power plant control and measurement systems.

Application of on-line data systems to generating stations was discussed by L. E. Jensen and W. W. Johnston, both of Information Systems, Inc. Two distinctly related phases—the information phase and the control phase—are necessary in planning for the successful application of on-line data systems in the automation of power plants, they said.

Economic advantages considered included: reduction in manpower, improved thermal efficiency, safer operation, improvement in maintenance scheduling, and improved future design.

MOUNT TOM POWER PLANT

Holyoke Water Power Company

Mount Tom Power Plant, paradoxically located in a region rich in ancient geological formation and prehistoric lore, is a symbol of modern American engineering achievement. The Riley Boiler is one of the most northern boilers in New England featuring outdoor construction.

Mt. Tom Power Plant's Complete Riley Reheat Coal Fired Boiler
Steam Capacity — 950,000 lbs/hr
Superheat/Reheat Temp. — 1000/1000 F
Pressure at Boiler — 1950 psig
Fired by low grade strip mine coal pulverized in four Riley Duplex Pulverizers.
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can fill your requirements for guying installations...

ALUMOWELD, made by the controlled atomic-welding process, combines aluminum and steel to give you strand with *permanent* high strength. The following facts tell you why Alumoweld should be your choice for guying installations.

STRENGTH—Alumoweld has a higher strength-to-weight ratio than any other strand used on overhead lines. Size for size, Alumoweld has the same tensile strength as extra-high-strength steel . . . weighs 18% less . . . and will last far longer.

CORROSION RESISTANCE—a *thick* cladding of pure aluminum—25% by area—gives Alumoweld the same long life and high resistance to corrosion as solid aluminum.

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LOW COST—Alumoweld not only gives you the money-saving benefits of low initial cost, but it eliminates maintenance costs for the life of your lines.

Supplies of Alumoweld Strand are available for prompt shipment from our warehouses in New York, Chicago, Pittsburgh and Memphis.

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COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION Glassport, Pa.

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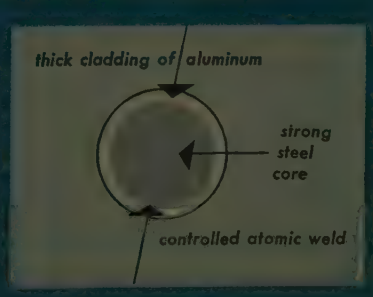
Canadian Distributor: NORTHERN ELECTRIC COMPANY LIMITED

and FOR OVERHEAD GROUND WIRES

You can string with smaller sags to increase mid-span clearance when you use Alumoweld for overhead ground wire. Its excellent conductivity—3 times as much as steel—is helpful in reducing service interruptions by quickly discharging transient currents to ground.



Utilize Lighter Equipment For Insulator Washing

Light weight pump unit allows 50 percent larger quantity of water to be carried, increasing working time.

Southern California Edison Co. has begun using a new lightweight, four-stage centrifugal pump specially designed for in-service washing of insulators.

The unit, known as the High-Line Model 2500, is adaptable to any of the truck chassis now in use by the company and allows the truck to carry 1800 gallons of water as compared to the 1200 gallons previously carried with heavier washing units. Total weight of the unit is 185 lbs.

Water discharge is made through a 65 ft or 75 ft boom which raises the hose to the desired level before water is forced onto the insulators. The unit can also be adapted for tower washing.

The High-Line unit has a working time of eight to sixteen hours a day. It delivers water at pressures in excess of 1000 psi and is operated from the back of the vehicle.

Dispose Of Radioactive Wastes In Cement

Consolidated Edison has purchased a specially designed unit to help dispose of radioactive waste from their Indian Point Atomic Power Plant. The unit, a turbine mixer, will utilize the wastes in cement.

According to the manufacturer, the T. L. Smith Co., this is the first mixer of this type specifically engineered to dispose of radioactive wastes.

Locked in a mass of concrete, the radioactive materials will then be poured into steel-drum molds and sealed at the top with regular concrete. After hardening, the drums of concrete containing the atomic wastes will be transported in shielding casks and disposed of at remote sites approved by the Federal government.

Due to the nature of the materials used, the mixer has been modified to allow remote control and operation.

Aluminum Base Improves Air Break Switch

Aluminum is now being used to make electric air break switch bases lighter, more rigid, and less expensive to manufacture, according to William Reynolds, executive vice president, Reynolds Metals Co.

The bases, designed and engineered by Reynolds are now being incorporated into the standard 115-kv air break switch line by I-T-E Circuit Breaker Co.

(Continued on next page)

Aluminum Base—Cont'd

Harry Wilcox, general manager of the Greensburg division of I-T-E said, "We found that fabricated aluminum base cost us less to produce than conventional steel bases.

"To fabricate the base we work with a single aluminum extrusion. First the extrusion is cut to length. Bolt holes are punched out, both top and bottom, at the same time.

"As the extrusion is made with an interlocking configuration we have only to put one extrusion into another and weld them together," Mr. Wilcox said.

He explained that the box design results in a superior base rigidity which takes torsional loads caused by short circuits better and allows installation with a greater overhang at the point of attachment.

Reynolds is currently developing a complete series of bases for all outdoor disconnecting switches from 7.5 kv to 340 kv.

Direct Mail Awards To Elec'l Manufacturer

Two imaginative direct mail campaigns utilized by the Pennsylvania Transformer division of McGraw-Edison Co. were recently awarded the Henry Hoke Gavel, symbolic of the most courageous or ingenious direct mail solution to a difficult sales problem.

Both campaigns were created by Irvin R. Isaacs, advertising manager for the division, who accepted the awards for the company.

The two campaigns revolved around a mythical world traveler named Petey (P.T. for Penn Transformer). Through a series of warm-hearted humorous letters Petey would recount to the reader his adventures which revolved around a new product or product improvement.

The "V.I.P." campaign stressed the durability of the company's vinyl with inner phosphate paint while the second campaign emphasized the insulating qualities of the firm's sky-blue paint for transformer covers.

Compartmentation Featured In Switchgear Design

Complete compartmentation of breakers, bus, and cable terminations are incorporated in a new low voltage drawout switchgear design by General Electric.

For use in utility generating stations using 600 v a-c and below, and in industrial and commercial applications, the type AKD-5 custom-line load center unit substation provides increased service reliability, convenience and operator safety. Current ratings are from 30 to 4000 amps.

Compartmentation of the equipment provides isolation against the spread of short circuits which could lead to costly downtime. Ample cable space is provided and run back conductors eliminate interleaving cable between phases thus allowing straight cable runs to the load studs.

Complete isolation of incoming conductors from the main bus and incoming line reduces the hazard of fault communication between main

(Continued on next page)

Compartmentation Featured—*Cont'd*

Operating personnel may rack GE Type AKD-5 Powermaster low voltage switchgear to connect, test, or disconnect position with the door closed. Photo shows from top, breaker in connected position, test position, and disconnect position. Bottom breaker is in fully withdrawn position. Positive interlocks prevent inserting or withdrawing breaker when closed.

bus and incoming line, and permits effective isolation by the main secondary breaker should a main bus fault occur.

Control devices and instruments are readily accessible from the front of the equipment. The control power transformer, potential transformer, and associated fuses are located in a separate auxiliary compartment in the front of the cabinet with provisions for easy removal. Current transformers are mounted around the breaker studs in the breaker compartment.

Breakers can be racked to connect, test, or disconnect position with compartment closed, by means of an integral racking mechanism. Equipment has positive interlocks for safety.

The equipment is available for separate mounting or as an outgoing section of a load center unit substation.

Penelec, GE Engineers To Study Lightning Effect On 460-Kv Line From Mountain-Top Trailer Laboratory

For the next two summers, two electrical engineers will work in a lightning-proof trailer atop a Pennsylvania mountain in an attempt to learn more about the phenomenon of lightning and its effect of EHV transmission lines.

The laboratory equipment, oscillographs, cameras, and other recording devices, will be connected to Pennsylvania Electric's 13-mile experimental 460-kv transmission line located a few feet away. The instrumentation is designed to

D. J. Heller, GE Power Transformer department engineer, makes adjustments in Penelec—GE Lightning Laboratory atop Dunning Mountain, adjacent to Pennsylvania Electric's 460-kv experimental transmission line.

count the number of strokes that hit the line and to read and record electrical field intensities, lightning wave shapes and amplitudes, and resulting line voltages. Oscillograph readings will be recorded on film and in many cases, high speed cameras will photograph the strokes simultaneously.

According to Dr. Pier A. Abetti, manager of General Electric's Project EHV, now under operation near Pittsfield, Mass., "A better understanding of lightning will assist utility engineers in achieving the proper balance betweeen economy and reliability in an EHV line."

SAFETY GROUNDING . . .

(Continued from page 53)

tion should be paid to the quality and condition of the conductors and connections used. These must be dependable under the most severe fault-current conditions likely to be encountered. In the case of connections, this requires clean, high-pressure contacts applied to properly-cleaned conductors. The presence of the apparatus may reassure us throughout many work operations, but it cannot protect if it disappears in a shower of sparks when subjected to maximum duty.

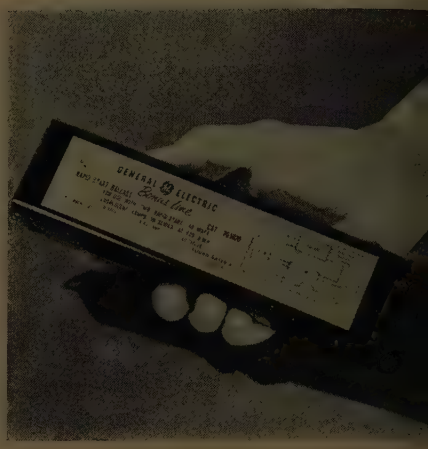
(2) Even when primary dependence is placed on bonding connections, the associated grounds should be good enough to ensure prompt fault clearance in the event of accidental energization.

(3) Lightning, although not mentioned earlier as a shock hazard, can in many instances present a serious hazard, and a very difficult protection problem. In general, work should be avoided during lightning storms in situations involving exposure. Where this is not possible, hazards are minimized by applying grounds and bonds at each work location.

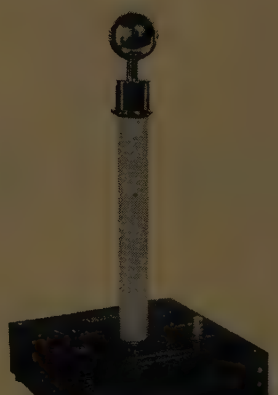
Reference 1: Protective Grounds for Safety of Linemen, Harrington and Martin, AIEE Transactions Paper 54-206, Power Apparatus and Systems, August 1954, p. 950.

Fully-Protected Ballast Eliminates Leakage, Burning

Full protection against the hazards sometimes associated with ballast end-of-life failure is offered in the new **General Electric** Bonus Line Ballast. The new design features two new developments. One is a non-resetting thermal protector which de-energizes the ballast before it reaches the critical temperatures at end of life that may cause ballast filling compound to soften. The second development is an improved capacitor with a new thermal link designed to overcome capacitor rupture and leakage which may occur at end of life. In addition, a new bushing assembly seals against capacitor dielectric seepage and contributes to ballast life. The units are interchangeable with other GE ballasts of the same rating. The design eliminates the need for individual ballast fusing.



Circle item #16 on reply card



Corona Pickup

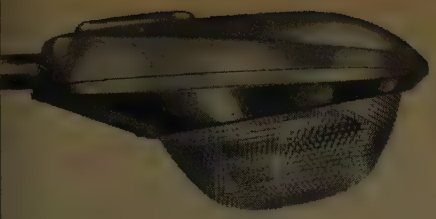
A corona pickup network to extract the corona signal from a high potential circuit has been introduced by **Associated Research, Inc.** Models are available for potentials up to 100 kv. Model 8562M1 consists of a corona-free high voltage capacitor-divider circuit, associated filters and circuitry. HV connection is at top of insulating cylinder, mounted on terminal base for connection to oscillograph or other corona detection device.

Circle item #17 on reply card

Aluminum-Coated Steel Wire

Alstan, an aluminum-coated steel wire has been developed by **National - Standard Co.** Aluminum coating of 20 to 60 percent of the total cross sectional area is applied over the steel core, giving electrical conductivity of 20 to 40 per cent of equivalent sizes of copper wire. In the photomicrograph above, the wire is 47 per cent aluminum by area, 33.8 per cent conductivity (as vs. copper). Pilot production has begun and limited quantities are now available in a range of wire sizes.

Circle item #18 on reply card



Built-in-Ballast Luminaire

The 400 Built-In-Ballast Mercury Luminaire by **Joslyn Mfg. and Supply Co.** has successfully withstood wind velocities of 125 mph in actual wind tunnel tests. In addition, the unit utilizes a new concept of mounting components on a sturdy saddle attached directly to a pipe bracket. Housing includes louvers and vent to insure cool operation of 400 watt lamp. Luminaire can be installed by one man due to ease of clamping and lightness of unit—ranging from 22 lbs without ballast to 41 lbs with constant-wattage ballast.

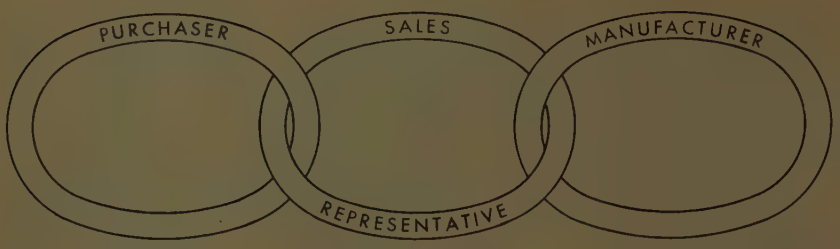
Circle item #19 on reply card

Group Operated Switch

Type RG-59 line tap-off switches are made in two- or three-way pole units. Available in standard ratings from 15 through 69 kv, 600 amps, the switch safely interrupts transformer magnetizing currents and line charging current. Also opens parallel currents and can be used to sectionalize loop circuits. Model RG-59 is mounted on a single wood pole with phases vertically separated. Manufactured by **Royal Electric Co.**

Circle item #20 on reply card

THE CONNECTING LINK



The **SALES REPRESENTATIVE** serves as a connecting link between the **PURCHASER** and the **MANUFACTURER**. The qualified rep is well informed concerning the customer's requirements and thoroughly familiar with the manufacturer's products. The rep's function of properly fitting together needs and products benefits all concerned.

The **PURCHASER** gains product application, quotation and expediting service. Also just and forthright handling of adjustments.

The **MANUFACTURER** gains a capable and efficient marketing organization at a predetermined low sales cost. The numerous contacts of each rep's sales personnel are especially valuable.

ELECTRICAL EQUIPMENT REPRESENTATIVES ASSOCIATION, founded in 1948, is dedicated to **BETTER SELLING** and **SERVICE**. Its members are ambitious to improve their performances and to benefit by the interchange of experiences and ideas with others in the same line of work.

Send for EERA Directory, listing the members, accounts handled and territories covered. It's free.

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EERA

ELECTRICAL EQUIPMENT REPRESENTATIVES ASSOCIATION

15-69 kv Switches

Type DH one-way and two-w switches, horizontally mount vertical break, with ultra-h speed arc restrictors and cast st pole bands are now offered **Turner Electric Co.** Switches designed for use with standard po type stand-off transmission in lators. Switches can be furnish in voltage ratings from 15 through 69 kv in current ratings 600 and 1200 amperes.

Circle item #21 on reply card

Heavy-Duty Trencher

A vertical boom, heavy-du trencher by **Century Engineeri Co.** allows operator to work flu with walls, curbs, and sidewal Less cross-sectional area of boom ground also facilitates steering. operating functions of the Trenc are hydraulically controlled, a only one man is necessary for eration, from hitch to ditch. U can be hitched directly to tru eliminating need for trailer, and m be towed safely from job to job highway speed. The Trenchit d 4 in. to 12 in. wide, to varia depths.

Circle item #22 on reply card

Air Gauges Perform Precision Inspection On Turbine Blades

A new device utilizing air gauges is providing accurate and efficient means of inspecting large finished turbine blade profiles for form alignment and size at the Allis-Chalmers West Allis Works.

By inserting the blades in the holding fixture, at the left, and closing two gates, 25 readings are obtained simultaneously. Center of gravity locations to an accuracy of 0.002 in. are indicated by the positions of the air floats in the adjacent flow gauges.

The air gauge inspection device is being used for steam turbine blade production as well as development work.

—Production Briefs—

S&C Electric Co. has acquired a 33,000 sq ft building adjacent to its Chicago manufacturing and research facilities which will be utilized for manufacturing and warehousing after modernization.

Increases in productive capacity of over 200 percent have resulted from the completion of **Precision Transformer Co.'s** new plant in the Centex Industrial Park west Northwest of Chicago. The plant is highly automated and enables Precision to turn out large specially-designed transformers as well as standard-sized dry and liquid models.

Allis-Chalmers has announced plans for a new 36,000 sq ft addition to plant 2 at its York (Pa.) Works. The expanded facilities are needed to handle the backlog of unfilled orders which have now totaled nearly $42-million, an all-time high for the York operation. Hydraulic turbines and valves are made at the plant.

—Sales Briefs—

Two new representatives have been added by **Fisher-Pierce Co.**, manufacturers of electrical and electronic equipment. The **T. R. Van Wagoner Co.**, Salt Lake City, Utah, will handle F-P's line of photoelectric streetlighting controls and associated equipment in Utah, southern Idaho, and western Wyoming. **Hamilton Associates** will handle the equipment from their Denver, Colo., office and serve Colorado, New Mexico, eastern and central Wyoming, and the El Paso area of Texas.

Allis-Chalmers has announced fou new distributors for their Indu tries Group. They are: Liber Electric Co., Liberty, Tex., distri utor for motors, generators, co trols, and transformers; Stang Ele tric Supply, Allentown, Pa., di tributor for motors, generator controls, transformers and circu breakers; Blue Ridge Hardware Supply Co., Inc., Bassett, Va., di tributor for motors and control and an agency for unit substation and Shealy Electrical Wholesaler Inc., Greenville, S. C., an agenc for regulators, power transformer switchgears, circuit breakers an capacitors.

Allis-Chalmers has named **Sout Bend Electric Co.**, South Bend, Ind distributor for A-C distributio transformers and an agency for A- power transformers, switchgea unit substations, and circuit breal ers. The firm will service the north eastern part of Indiana and south western Michigan. Allis-Chalmer also appointed Lasco Products Equipment Co., St. Louis, Mo., di tributor for motors, centrifugal an vacuum pumps, rotary compressor and water conditioning equipmen serving eastern Missouri and wes ern southern Illinois.

Westinghouse Electric Corp. ha expanded its Total Electric Hom program into a newly formed orga ization—the residential marketin department. William H. Loebe former TEH marketing manage has been named manager, reside tial marketing department.

R. S. Hughes Co., Inc., Los Angele has been named exclusive di tributor in 11 western states f Teflon extruded and wrapped wi and multi-conductor Teflon cable The manufacturer of Teflon pro ucts is the **Philadelphia Insulate Wire Co.** Mr. Hughes has hea quarters at 4515 Alger Street, L Angeles 39, Cal.

The Fisher-Pierce Co., has a pointed **Dale P. Seyfried Co.**, as sales representative. Seyfried wi handle the complete Fisher-Pier line of photoelectric streetlightin controls.

Cowart Elected Atlantic City VP

Cowart

William S. Cowart, Jr., has been elected vice president of the Atlantic City Electric Co.

Mr. Cowart has been engaged in marketing and engineering studies since joining the east coast utility in September, 1960. He previously was director of the National Aviation Facilities Experimental Center (NAFEC).

An EE graduate from Ohio State University in 1940, Mr. Cowart is the discoverer of Selenium 73, discovered while at ISU. He also holds a Master of Science degree in Physics from OSU.

Mr. Cowart was director of operations of the first Thermo-Nuclear Device Test and director of the first H-Bomb Test. He became director of NAFEC in 1958.

Pilcher To FPC Post

Milton A. Pilcher, former budget examiner with the Bureau of the Budget, has become director of administration for the Federal Power Commission.

Mr. Pilcher succeeds J. Kay Lindsay, who resigned September 3 to join the International Cooperation Administration.

As head of the Commission's Office of Administration, Mr. Pilcher will be responsible for conducting studies of bureau and office work programs, making recommendations necessary to most effectively accomplish the FPC's responsibilities and functions under the statutes it administers. His office will handle the agency's centralized administrative functions, including budget and fiscal management, library facilities, management analysis, and general services such as procurement, property, and the like.

Mr. Pilcher joined the REA in 1940 and served with it until 1949.

AP&L Elects Three

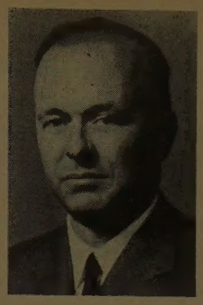
Three officers have been elected by the board of directors of the Arkansas Power & Light Co. They are: Treasurer Wallace H. Harrell, elected secretary of the corporation; A. B. Coen, elected assistant treasurer; and J. D. Doyle, elected assistant secretary.

Mr. Harrell continues as chief financial officer and assumes the additional duties as corporate secretary. He has served as treasurer since 1957. He joined AP&L as a bookkeeper in 1926, worked as an auditor, and was elected assistant treasurer in 1942.

Mr. Coen has also been with the company for 34 years. He was made assistant to the treasurer in 1959, having served as general storekeeper since 1936.

Mr. Doyle was appointed comptroller in the Treasury department of the company last September.

Bechtel Corp. Elects President



Bechtel

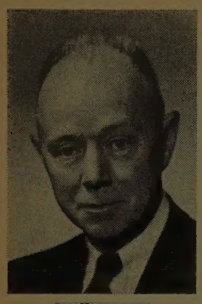
Stephen D. Bechtel, Jr., has been elected president of Bechtel Corp., International engineers and constructors organization with headquarters in San Francisco.

The election of S. D. Bechtel, Jr., marks the third generation of Bechtel leadership in the company.

Mr. Bechtel began work with the firm as a student engineer and started full time employment in 1948 as a field engineer. He held various field positions before taking over the management of pipeline operations in the U. S. and Canada in 1952 as a vice president.

In 1955 he was elected senior vice president and director of the Bechtel Corp. He shortly thereafter assumed the chairmanship of Canadian Bechtel Limited. Two years later he was named executive vice president of the parent corporation.

New Duties For Williamson



Williamson

Gerald V. Williamson has been appointed vice president-operations executive of the Union Electric Co. A former vice president-production and distribution, he has been with the St. Louis utility since 1922.

A mechanical engineering graduate of Washington University, Mr. Williamson is a past chairman of the St. Louis section of Mechanical Engineers and is currently vice-chairman of the St. Louis Section of the Missouri Society of Professional Engineers.

He is also active in a number of air pollution organizations.

—Utilities—

Joseph H. Purdy has been appointed director, public relations, of the Baltimore Gas and Electric Co.

Two appointments have been an nounced by Vice President **R. Dirksen,** New Bedford Gas and Ed son Light Co.; **Lester H. Faulkin ham** has been named superintend ent of electric operations, an **Malcolm Mager** has been mad assistant superintendent of ga operations.

Verne A. Sechler, former industri sales supervisor, Ohio Power Co has been promoted to the industri sales division of American Electri Power Service Corp.

Charles J. Smith has been ap pointed news director of the Cen tral Hudson Gas and Electric Corp He is succeeded as editor of th Central Hudson Bulletin b Peter R. Durdash.

Three divisions of the Pennsylvani Electric Co. system have new man agers. **Royal A. Pickup** has becom manager of the northwestern divi sion, succeeding **Kenneth H. Ishle** who has retired; **Frank W. Wome Jr.,** has succeeded Mr. Pickup a manager of the northern division **N. Gwynne Dodson** steps into th position vacated by Mr. Womer a eastern manager.

Southern Services has named **J. M Reynolds** vice president and comp troller. He will assume the dutie formerly handled by **R. H. Frees** who retired recently. **W. B. Hors burgh** was named treasurer an assistant comptroller.

Lieutenant General **James M Gavin,** (USA-ret.) president an director of Arthur D. Little, Inc an international research and eng neering company, has been electe a director of the American Electri Power Co.

James P. Hayward, executive vic president of Atlantic City Electri Co., has been elected president the New Jersey Utilities Associa tion by the Association's board directors at the annual meeting.

Alan Good has been elected assis ant controller at Northern Indian Public Service Co.

Manufacturers

Southern States Equipment Co. has announced two promotions: **H. C. Anderson** is the new sales manager—protective equipment, and **John M. Tomme** has been named sales manager—power switching equipment.

Consolidation of the steam turbine and heat transfer departments into the new thermal power department has been announced by Allis-Chalmers. **J. H. Burrus** has been appointed manager and **John M. Crawford** assistant of the department.

Clark Nichols has been made manager of the systems engineering division of Leeds & Northrup Co. He was formerly head of the L&N application engineering utilities section.

Nuclear Utility Services, Inc., has announced that **Dr. C. Rogers McCullough** has joined the company as director of reactor safeguards and scientific adviser to the board of directors.

Westinghouse scientist **Dr. Kuan H. Sun,** manager of the company's radiation and nucleonics laboratory, has been honored with a 1960 Achievement Award of the Chinese Institute of Engineers of New York.

Charles W. Elston has been named general manager of General Electric's Large Steam Turbine-Generator department at Schenectady. He

Elston Howard

succeeds W. E. Saupe who has retired. **Alan Howard,** who has been manager-engineering for the Medium Steam Turbine Generator and Gear department at Lynn, Mass., will succeed Mr. Elston as general manager of the Gas Turbine department.

Energization of 150-kv Project . . . (Cont'd)

Companies Participating In Project EHV

Name	*Contribution(s)*
Aluminum Company of America*	line conductors, spacers and hardware; station structures and buses; one aluminum tower, lightning rods
Aluminium Ltd.	guyed aluminum tower
American Bridge Division of United States Steel*	design of three portal transmission towers
Anchor Metals, Inc.	one steel tower
Brewer-Titchener Corp.*	forgings for corona shields and hardware
Commonwealth Associates, Inc.	design of two steel towers
Petersen Engineering Co.*	tension-stringing equipment
Prestressed Concrete Institute	prestressed concrete tower
Rilco Laminated Products and Weyerhaeuser	laminated wood tower
Stone & Webster Engineering Corp.*	right-of-way acquisition, line design and erection
Western Massachusetts Company*	electric power, system design and operation

*contributors to the northern section

General Electric Departments Participating In Project EHV

Name	*Contribution(s)*
Power Transformer Dept.	project design, supervision and operation; power transformer, regulating transformer, isolating transformer
Canadian General Electric Co.	gas-filled capacitors
Capacitor Dept.	capacitor potential devices, series capacitors
Communications Products Dept.	coupling capacitors, line traps, carrier current microwave equipment
Computer Dept.	data gathering equipment analog-to-digital converters
Distribution Transformer Dept.	distribution transformers
High Voltage Switchgear Dept.	disconnecting and phase-reversing switches; air-blast circuit breakers
Instrument Dept.	chart recorders and instruments
Insulator Dept.	insulators, conductor hardware, bus insulators
Lightning Arrester and Cutout Section	lightning arresters
Low Voltage Switchgear Dept.	relays
Medium Voltage Switchgear Dept.	control equipment
Meter Dept.	metering equipment

Fritz L. Meeske, for 41 years prominent in the development of the magnetic wire industry, has retired as vice president of the Anaconda Wire and Cable Co. He continues as a director.

J. N. Marshall has been appointed to the position of manager, advanced systems development engineering, RCA Electronic Data Processing division.

Named sales manager for Hitemp Wires Co. was **Theodore R. Sheron.**

Appointment of **Robert L. McMasters, Jr.,** supervisor distributor promotion, and **Donald E. King,** supervisory engineer, special control, engineering group, has been announced by the Allis-Chalmers control department.

Appointed consultant—sales and distribution planning for marketing services at General Electric is Kristian H. Christiansen.

CALENDAR OF EVENTS

January 17-19—Instrument Society of America, Winter Instrument-Automation Conference and Exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis, Mo.

January 19-20—Edison Electric Institute, Transmission and Distribution Committee, Warwick Hotel, Philadelphia, Pa.

January 23-24 — Edison Electric Institute, Electric Space Heating and Air Conditioning Committee, New Orleans, La.

January 23-27 — Doble Engineering Conference, Boston, Mass.

January 25-26 — Southeastern Electric Exchange, Legal and Claims Committee Meeting, Miami Beach, Fla.

January 26-27—Pennsylvania Electric Association, Engineering Section, Communications Committee Meeting.

January 29-February 3—American Institute of Electrical Engineers, Winters General Meeting, Statler Hotel, New York, N. Y.

February 1-2—Edison Electric Institute, Commercial Cooking and Water Heating Committee, Atlanta, Ga.

February 2-3—Pennsylvania Electric Association, Prime Movers Committee.

February 5-7—National Association of Purchasing Agents, Public Utility Buyers Group, Detroit, Mich.

February 8-9 — Pennsylvania Electric Association, Transmission and Distribution Committee, Penn Harris Hotel, Harrisburg, Pa.

February 9-10 — Pennsylvania Electric Association, Systems Operation Committee, Harrisburger Hotel, Harrisburg, Pa.

February 13-16—American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Annual Meeting and 15th International Heating and Air-Conditioning Exposition, International Amphitheatre, Chicago, Ill.

February 16-17—Pennsylvania Electric Association, Engineering Section, Electrical Equipment Exposition, Pick-Roosevelt Hotel, Pittsburgh, Pa.

February 23-25—National Wiring Bureau, 17th Annual National Wiring Sales Conference, Sherman Hotel, Chicago, Ill.

March 5-8—Third Annual Lighting Exposition, World Lighting Forum, New York Coliseum, New York, N.Y.

March 5-9—American Society of Me chanical Engineers, Sixth Annual Ga Turbine Conference, Shoreham Hotel Washington, D. C.

March 9-10 — AIEE, IAS, IRE, Second Symposium on Engineering Aspects o Magnetohydrodynamics, University o Pennsylvania, Philadelphia, Pa.

March 21-23—American Power Confer ence, Sherman Hotel, Chicago, Ill.

March 27-29—Southeastern Electric Ex change, Annual Conference, Boca Raton Hotel and Club, Boca Raton Fla.

April 6-7 — American Society of Me chanical Engineers, Management En gineering Conference, Statler Hilto Hotel, New York, N. Y.

April 6-7—Pacific Coast Electrical A sociation, Engineering and Operatin Section, Ambassador Hotel, Los An geles, Calif.

April 17-18—Pacific Coast Electrical A sociation, Business Development Se tion, Sheraton - Palace Hotel, Sa Francisco, Calif.

April 27-28—Pacific Coast Electrical A sociation, Administrative Services Se tion, Villa Hotel, San Francisco, Cal

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